United States National Grid

USNG

IEM

When Landmarks Change . . . . .

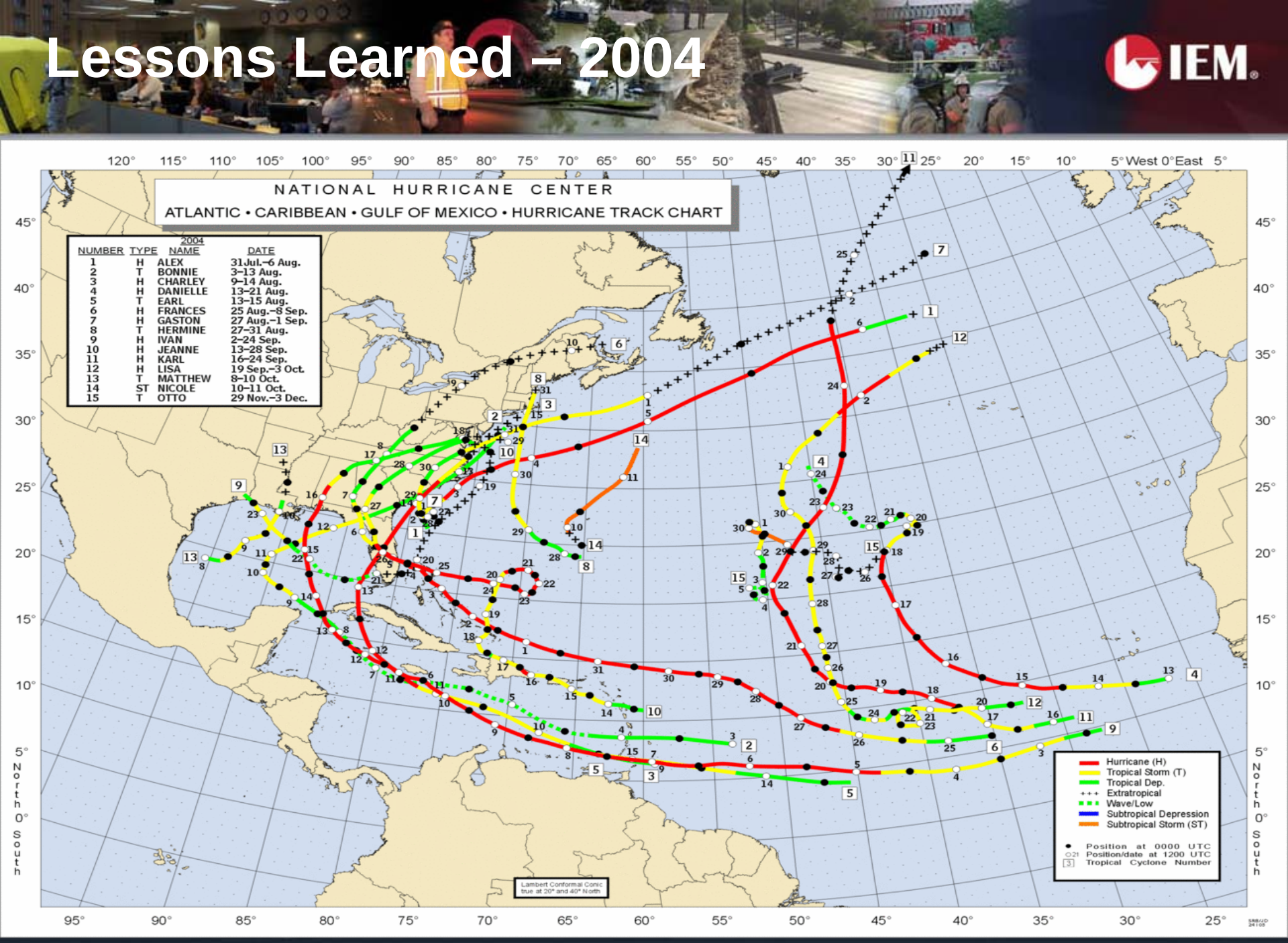
What do you do when the roads get covered and signage destroyed?

Lessons Learned

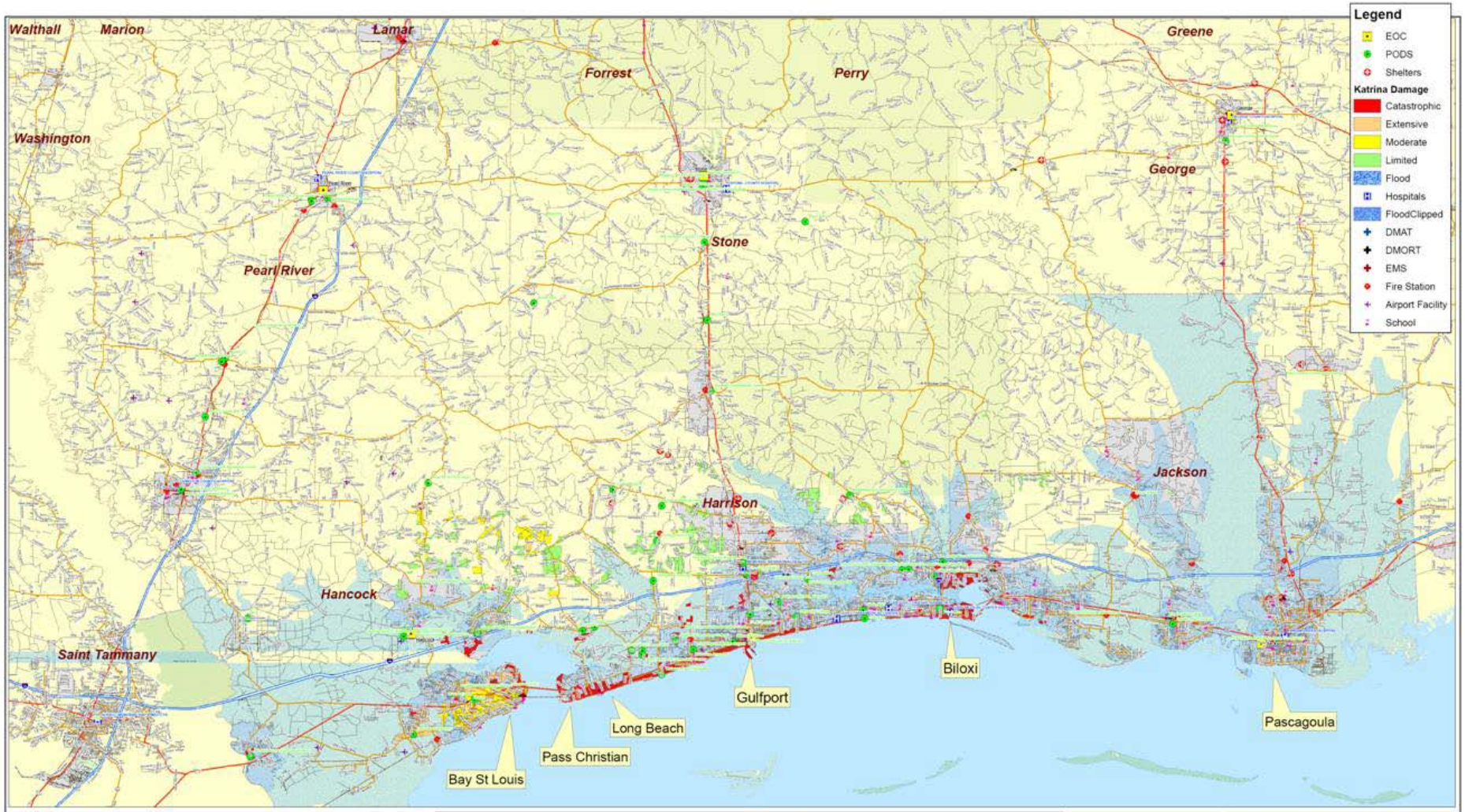
AGENDA

- Overview & Lessons Learned
- What is the US National Grid
  - No Tech; Lo Tech; High Tech Solution
- Unified Response
  - Operationalizing
  - Situational Awareness
  - Pre-scripted Mission Assignments
- Reading the USNG

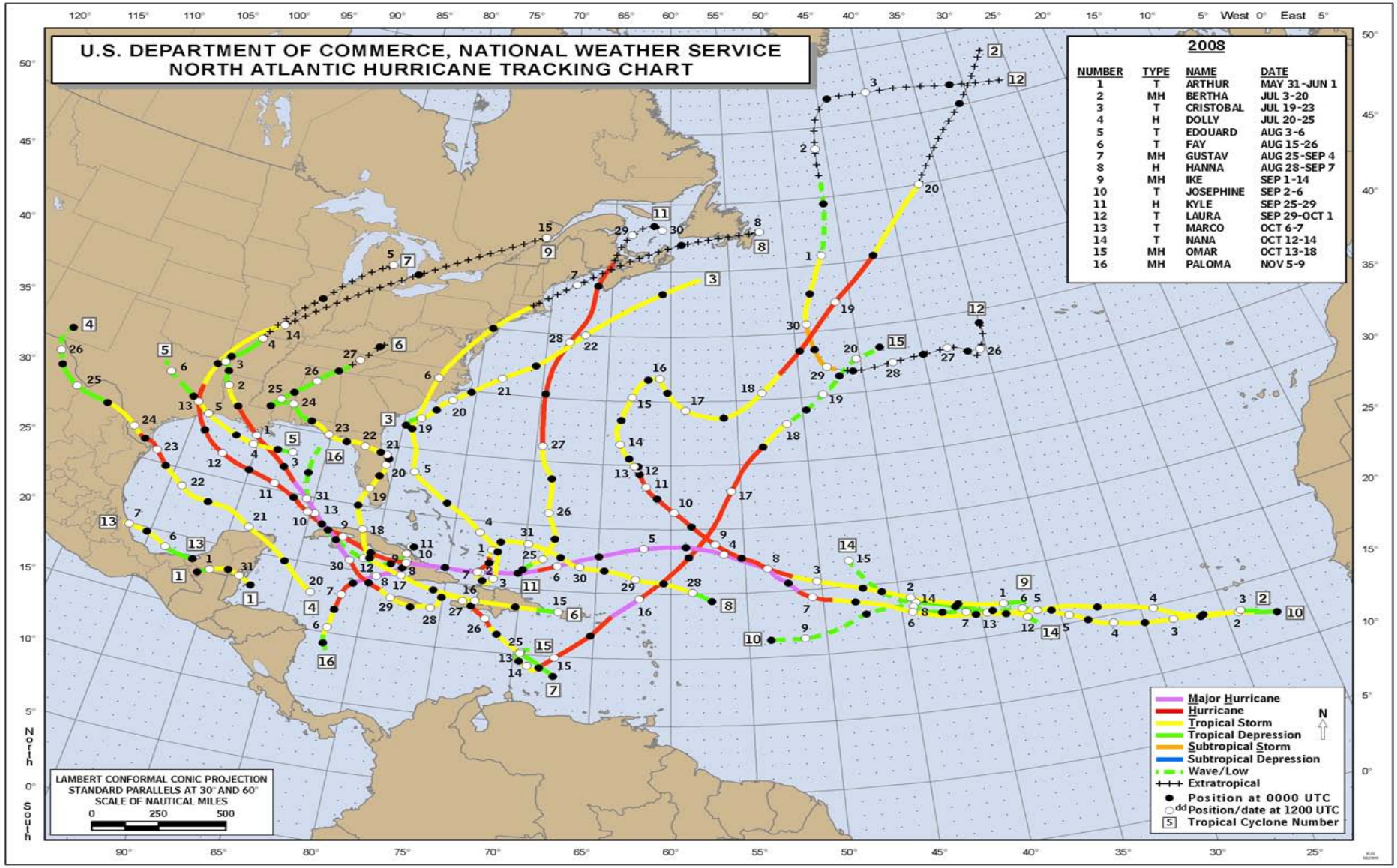
Lessons Learned – 2004



Lessons Learned - 2005

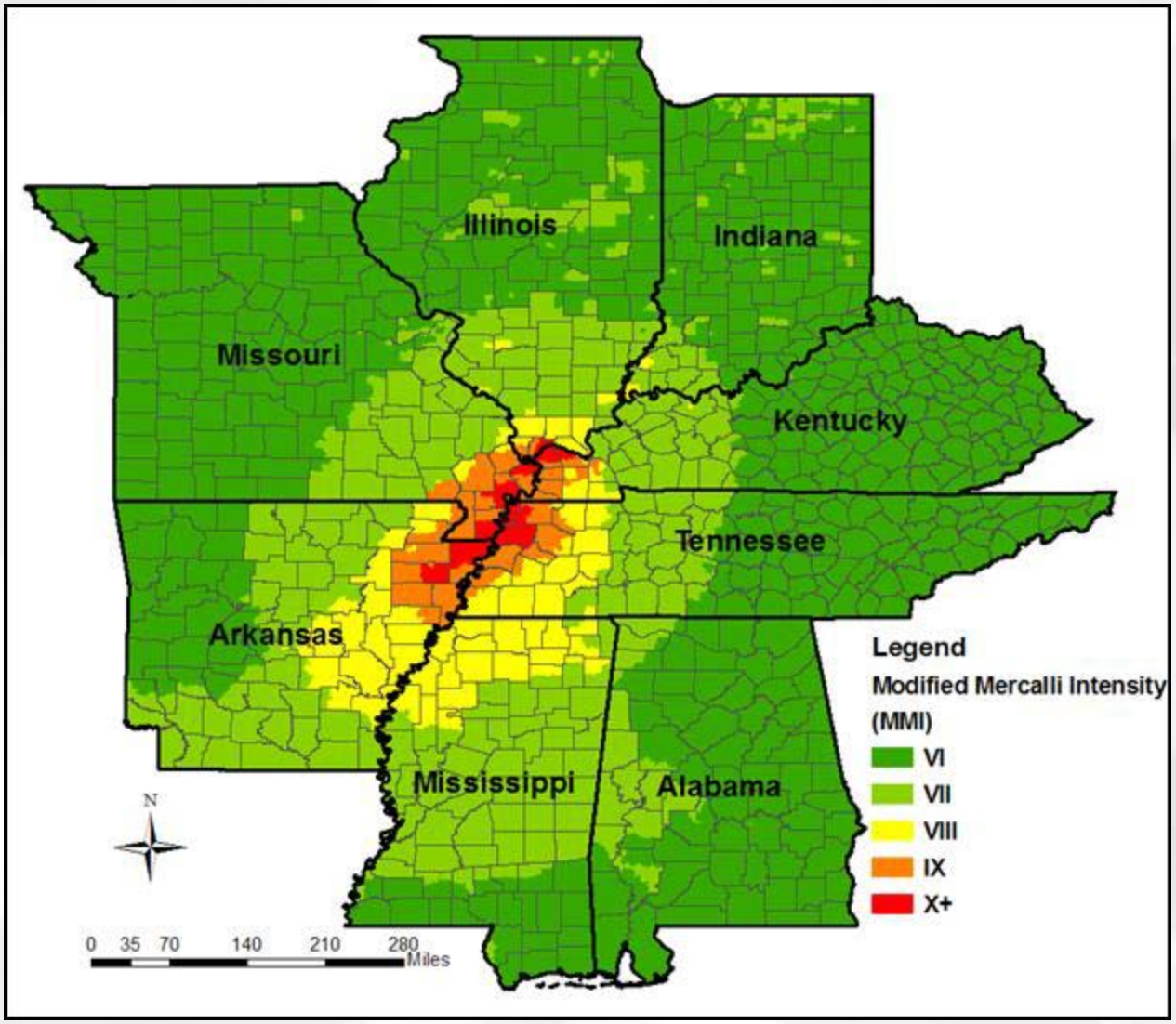


Moving Forward – 2008 & Beyond



Not if…When

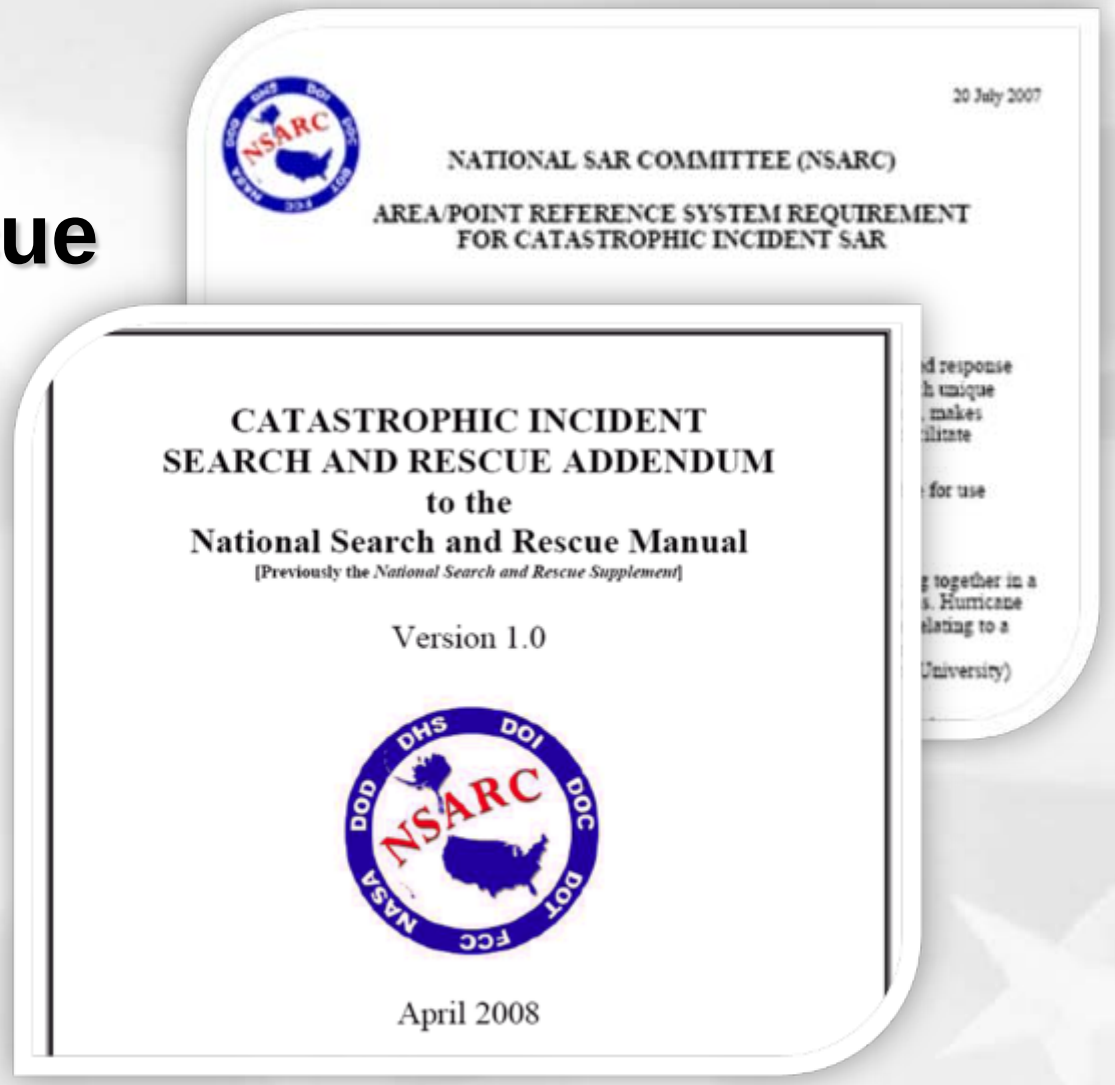
- 8 States directly impacted
- Mutual aid will be necessary from across the country



Recurring Theme

Nearly every after action report, post any large scale or regional disaster clearly indicates the need for a common grid

National Search & Rescue Committee



20 July 2007

NATIONAL SAR COMMITTEE (NSARC)

AREA/POINT REFERENCE SYSTEM REQUIREMENT FOR CATASTROPHIC INCIDENT SAR

CATASTROPHIC INCIDENT
SEARCH AND RESCUE ADDENDUM
to the
National Search and Rescue Manual
[Previously the *National Search and Rescue Supplement*]

Version 1.0

April 2008

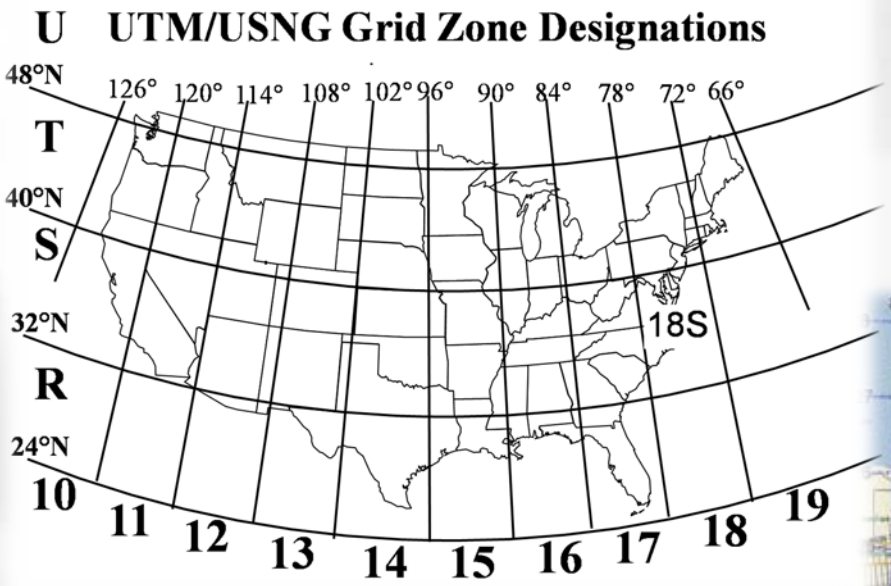
Catastrophic SAR : GeoReferencng Matrix

User	USNG	Latitude/ Longitude DD-MM.mmm[1]	GARS
Land SAR	**Primary**	Secondary	N/A
Aeronautical SAR	Secondary	Primary	Tertiary
Air Space Deconflication	N/A	Primary	N/A
Land /Aeronautical Interface	**Primary**	Secondary	N/A
Incident Command			
Air SAR Coordination	Secondary	Primary	N/A
Land SAR Coordination	**Primary**	Secondary	N/A
Organization & Accountability	Secondary	Tertiary	Primary

[1]During CIS operations (and to avoid confusion) Latitude and Longitude should be in one standard format DD-MM.mmm

Do not use leading zeros to the left of the decimal for degrees or minutes

US National Grid (USNG)



USNG: What is it?

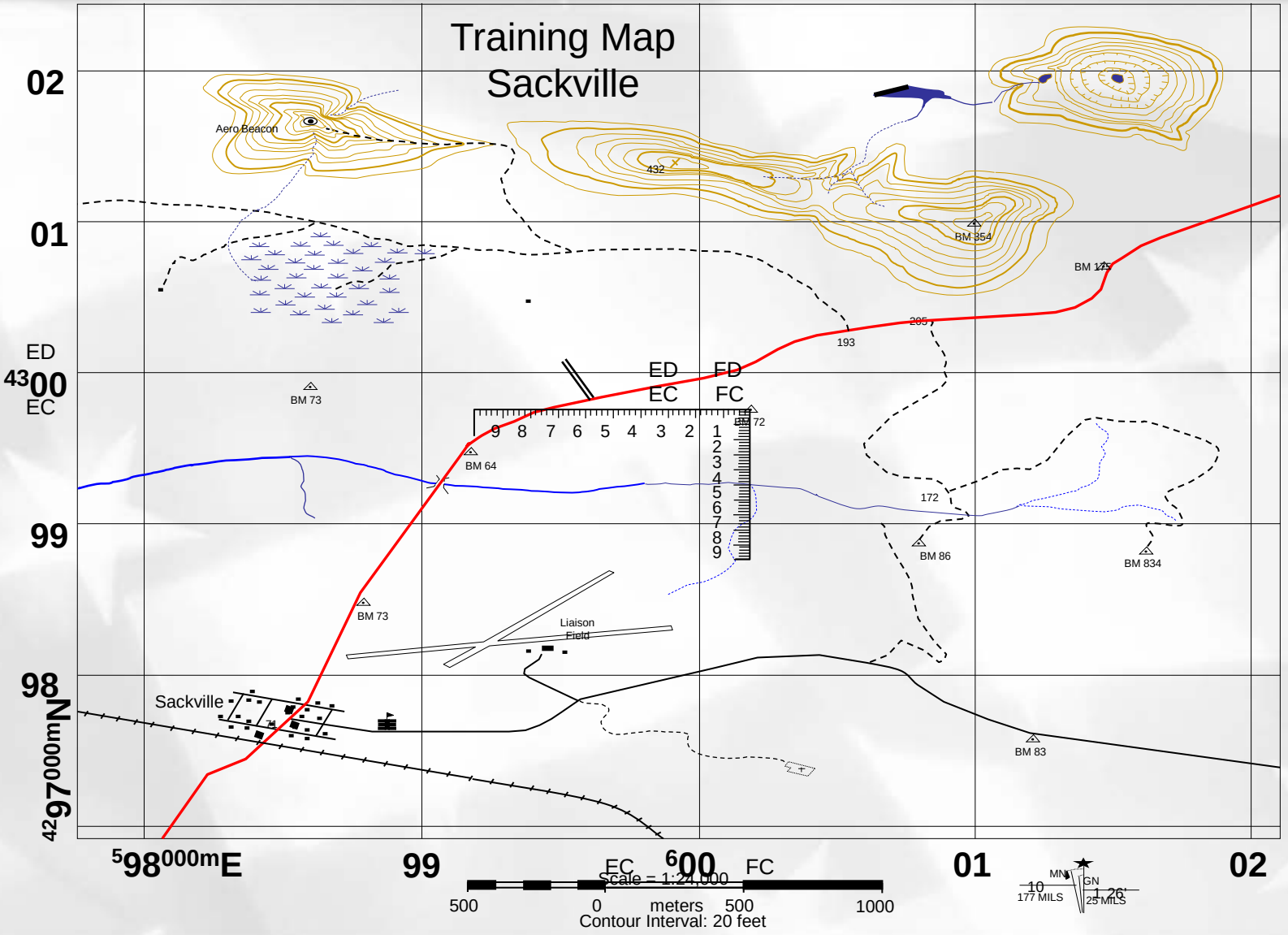
- US National grid (USNG) is **both** a point and **AREA** grid reference system
- Flexible precision (100K, 10K, 1K, 1m)
- Functionally equivalent to the MGRS which is in use by all branches of the military
- Allows for a common grid reference system (universal spatial language)
- Established as NATIONAL standard in 2001

Accuracy

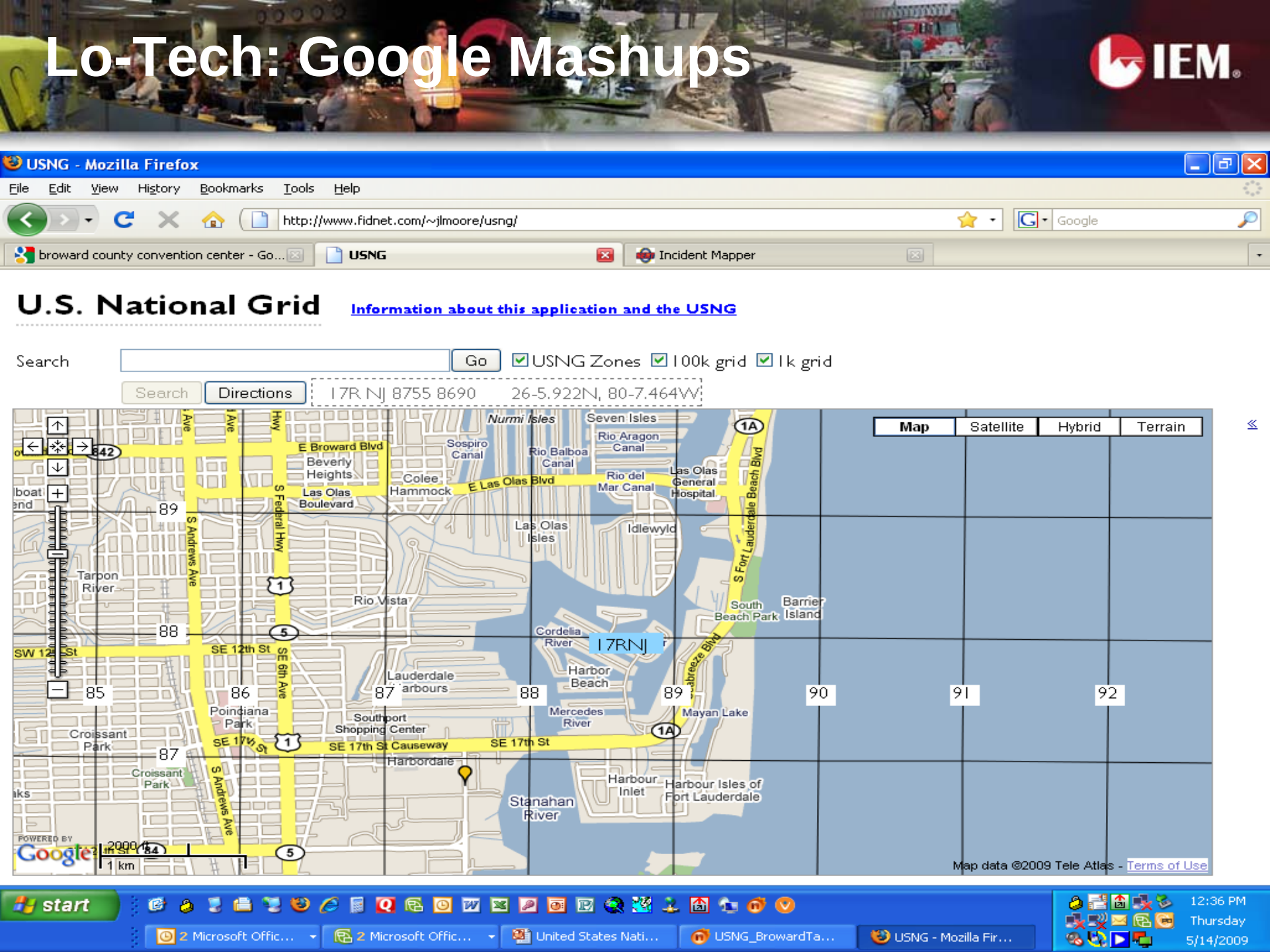
- **Coordinates are represented in pairs**
  - Eastings & Northings
- **Number of digits determine precision**
- **16RGU61 07 – 4 digits = 1km**
- **16RGU610 704 – 6 digits = 100m (football field)**
- **16RGU6103 7043 – 8 digits = 10m (modest sized home)**
- **16RGU61031 70436 – 10 digits = 1m (parking space)**

GZD	100,000m	Coordinate	
16R	**GU**	61**03**	70**43**

No Tech: Map Atlas compass, straightedge & pen



Lo-Tech: Google Mashups



Lo-Tech: Imagery

U.S. National Grid

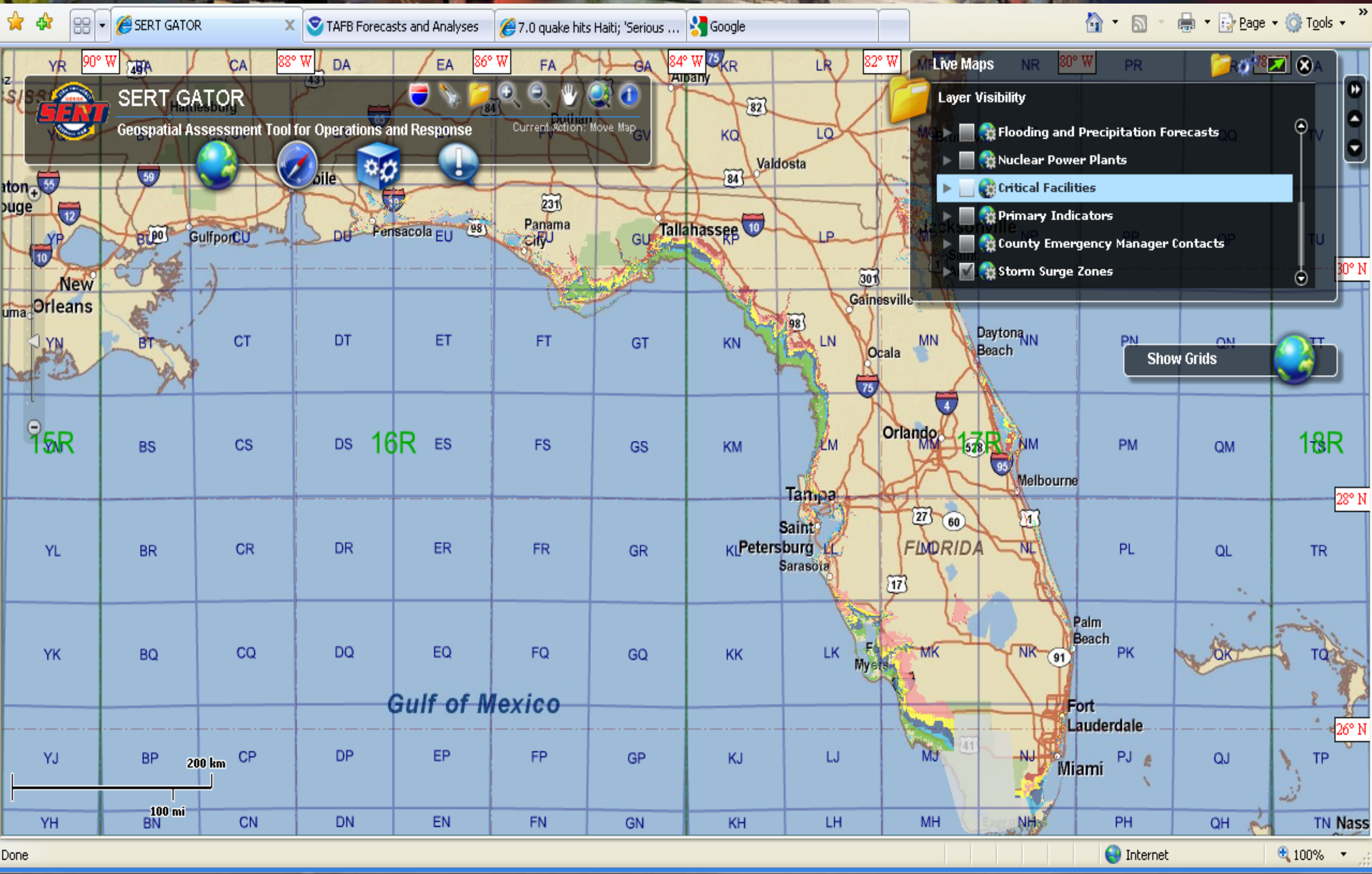
Information about this application and the USNG

Search Go ☑ USNG Zones ☑ 100k grid ☑ 1k grid

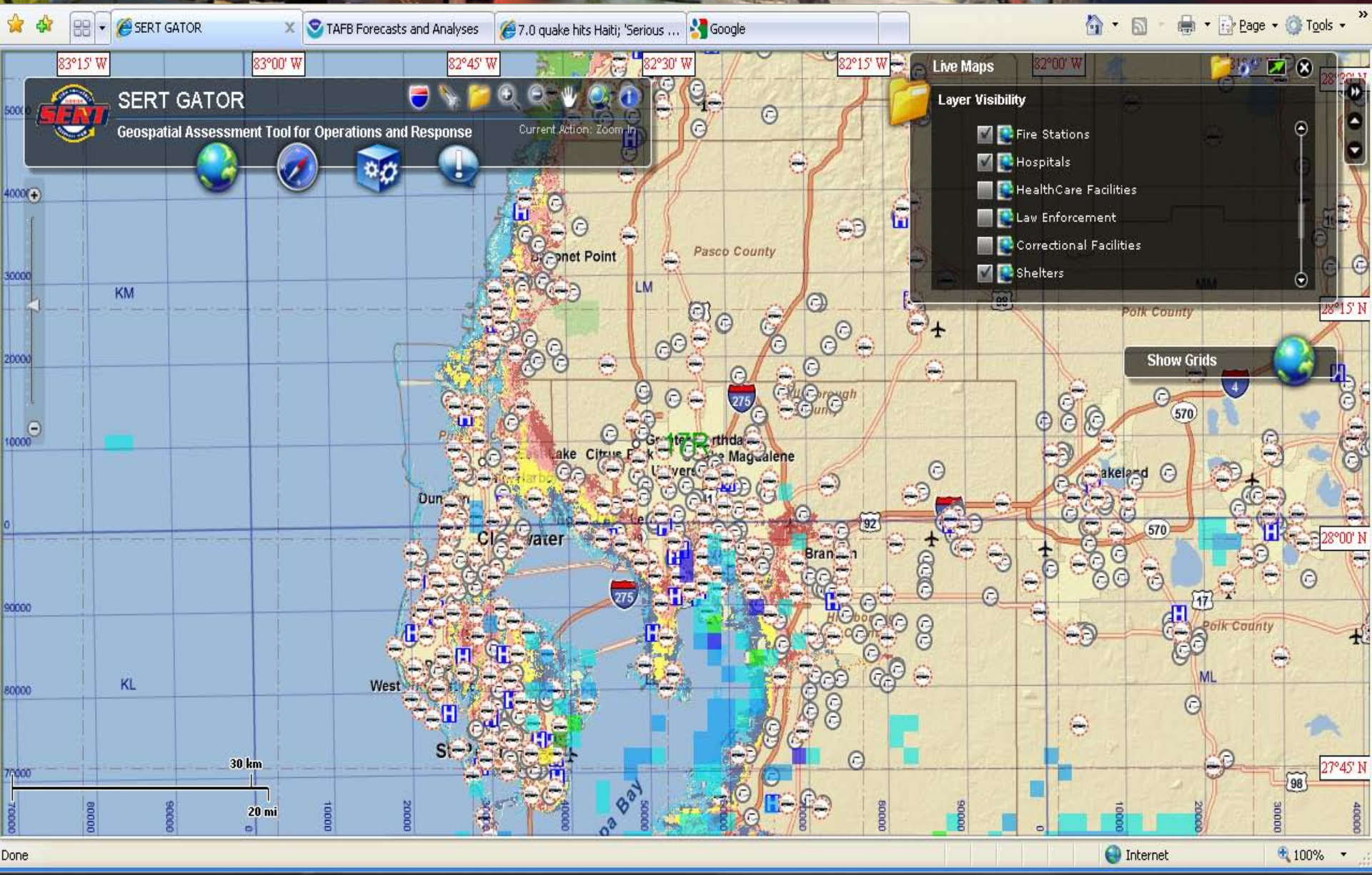
Search Directions 16S FD 5325 7857 35-2.292N, 85-19.188W

http://www.fidnet.com/~jlmoore/usng/

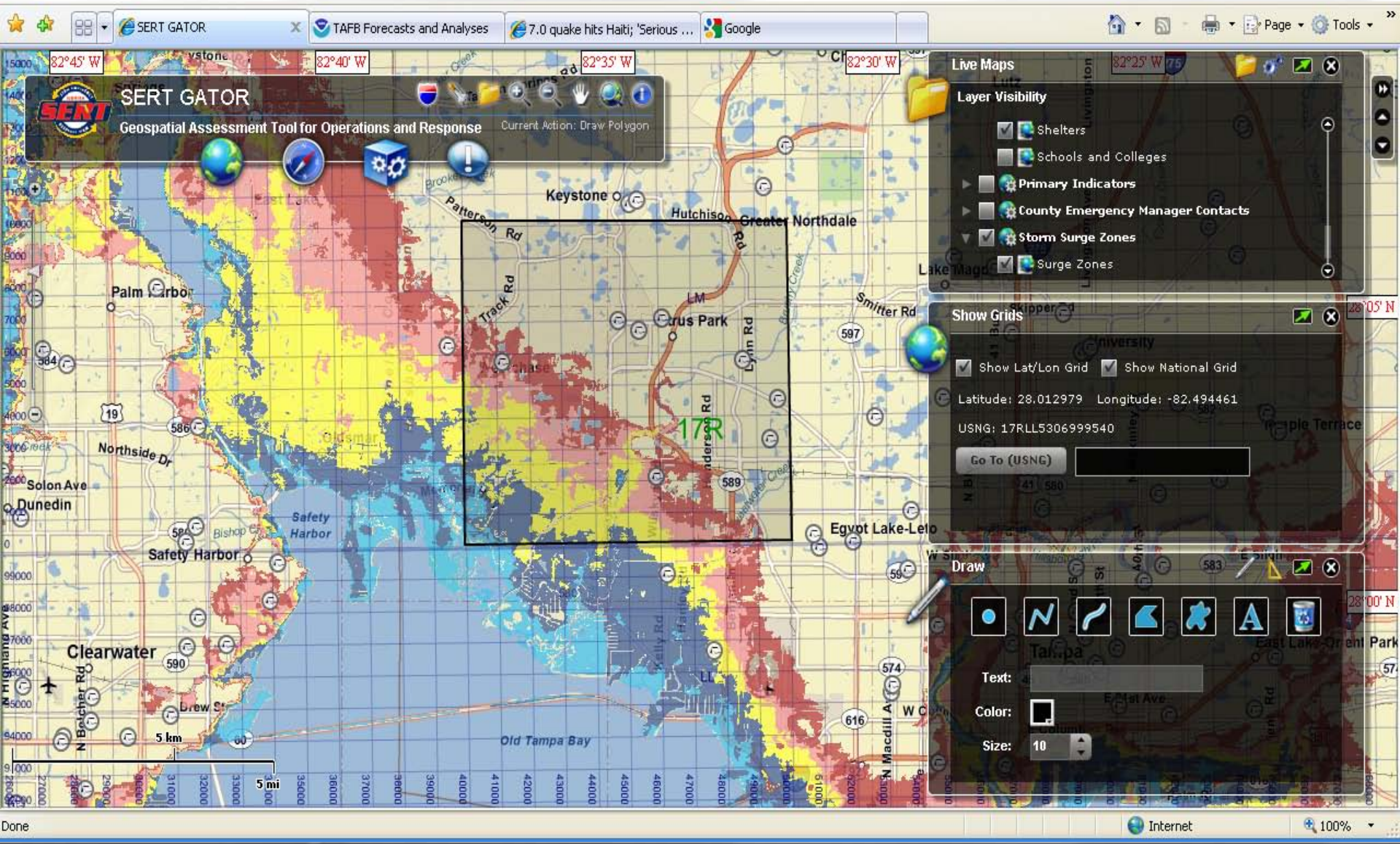
Lo-Tech: Web Based Resources



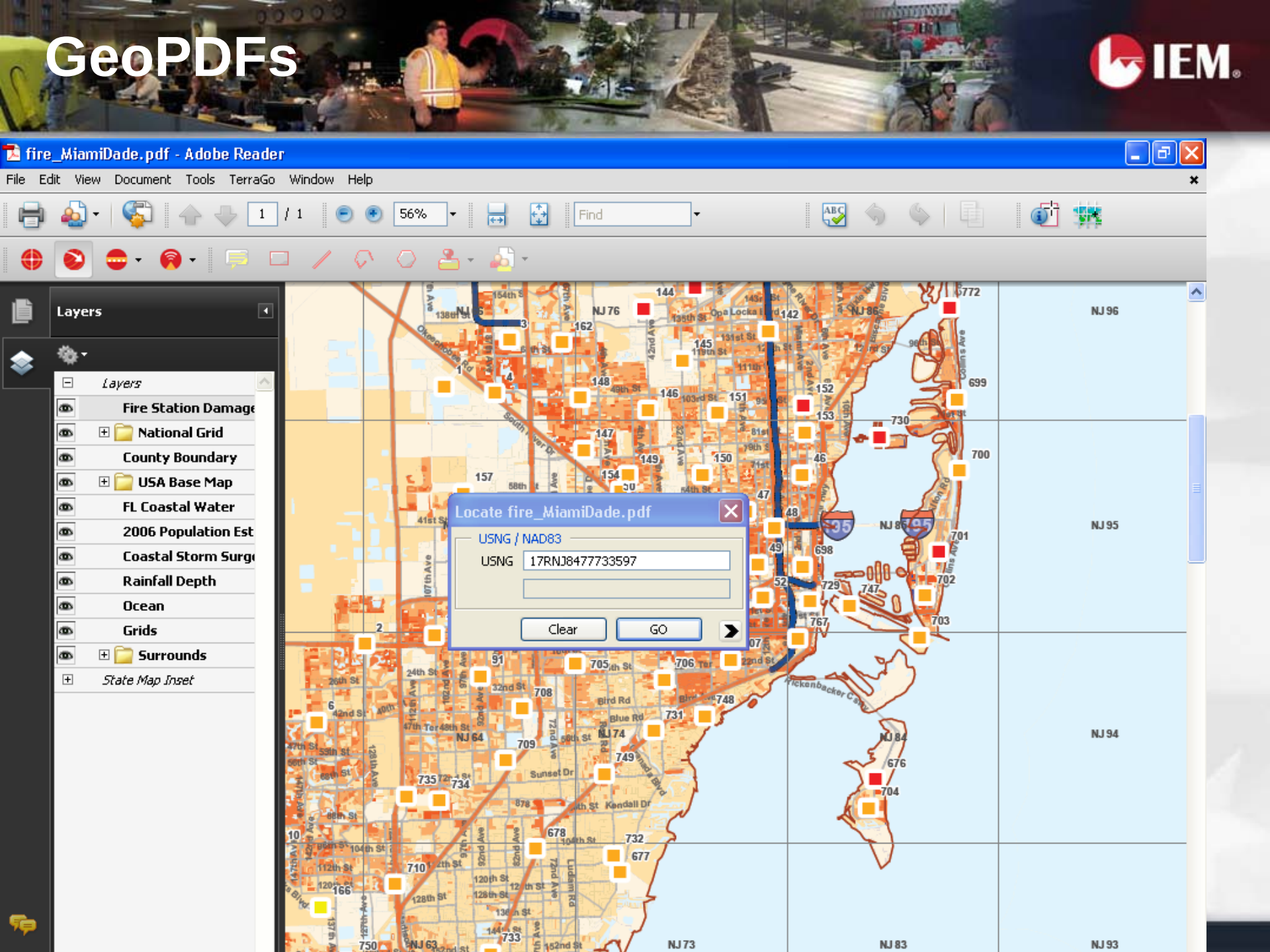
Lo-Tech: Web Based Resources



Lo-Tech: Web Based Resources



GeoPDFs


fire_MiamiDade.pdf - Adobe Reader
File Edit View Document Tools TerraGo Window Help
Layers
Layers
Fire Station Damage
National Grid
County Boundary
USA Base Map
FL Coastal Water
2006 Population Est
Coastal Storm Surge
Rainfall Depth
Ocean
Grids
Surrounds
State Map Inset
Locate fire_MiamiDade.pdf
USNG / NAD83
USNG
17RNJ8477733597
Clear
GO

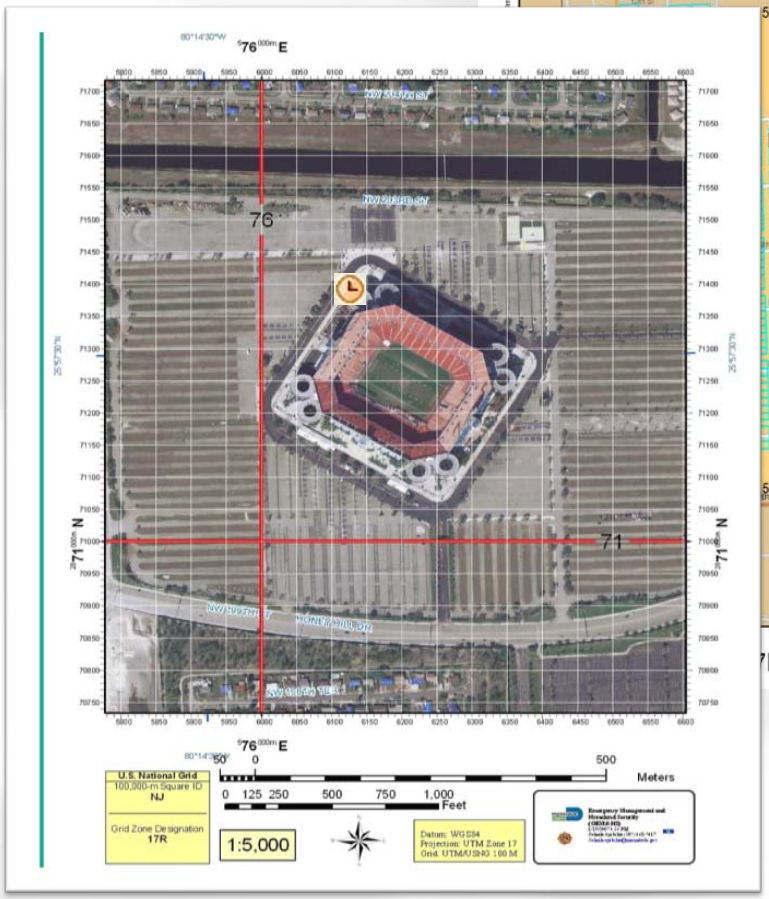
Virtual USA

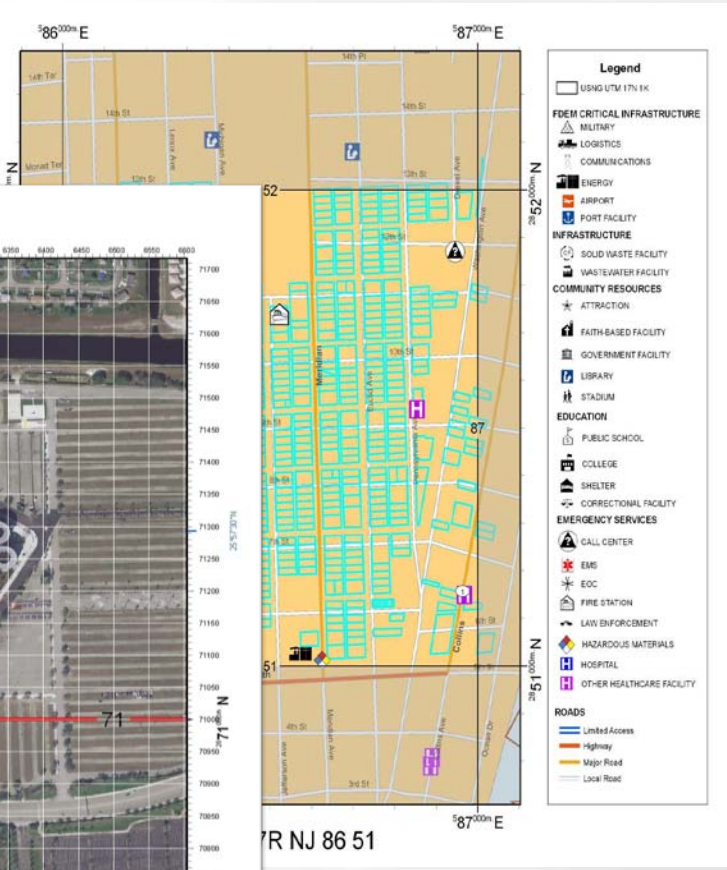
Virtual USA:

- Integrates Existing Frameworks and Investments
- Draws on Practitioner Input
- Employs a Comprehensive Approach
- Provides a Flexible, Accessible Platform
- Involves Everyone

High Tech

- GIS Analysts
- Spatial Analysis
- IT Platforms / Servers





High Tech - Analysis

Health Care for USNG 17S NJ 8651

Facility Type	Emer_Funct	Name	Address1	City	County	Zip	USNG
HOSPITAL	ES	SOUTH BEACH COMMUNITY HOSPITAL	630 ALTON ROAD	MIAMI BEACH	86	33139	17R NJ 86141 51183
CLINICAL LABORATORY	ES	MIAMI BEACH COMMUNITY HEALTH CENTER	710 ALTON ROAD	MIAMI BEACH	86	33139	17R NJ 86138 51302
CLINICAL LABORATORY	ES	MIAMI DADE COUNTY HEALTH DEPT / LAB SERV	615 COLLINS AVENUE	MIAMI	86	33139	17R NJ 86966 51150
RESIDENTIAL TREATMENT FACILITY	ES	DOUGLAS GARDENS C.M.H.C./ CRISIS RESIDEN	629 LENOX AVENUE	MIAMI BEACH	86	33139	17R NJ 86284 51191
SKILLED NURSING FACILITY	ES	OCEANSIDE EXTENDED CARE CENTER	550 9TH STREET	MIAMI BEACH	86	33139	17R NJ 86853 51538

Emergency Services for USNG 17S NJ 8651

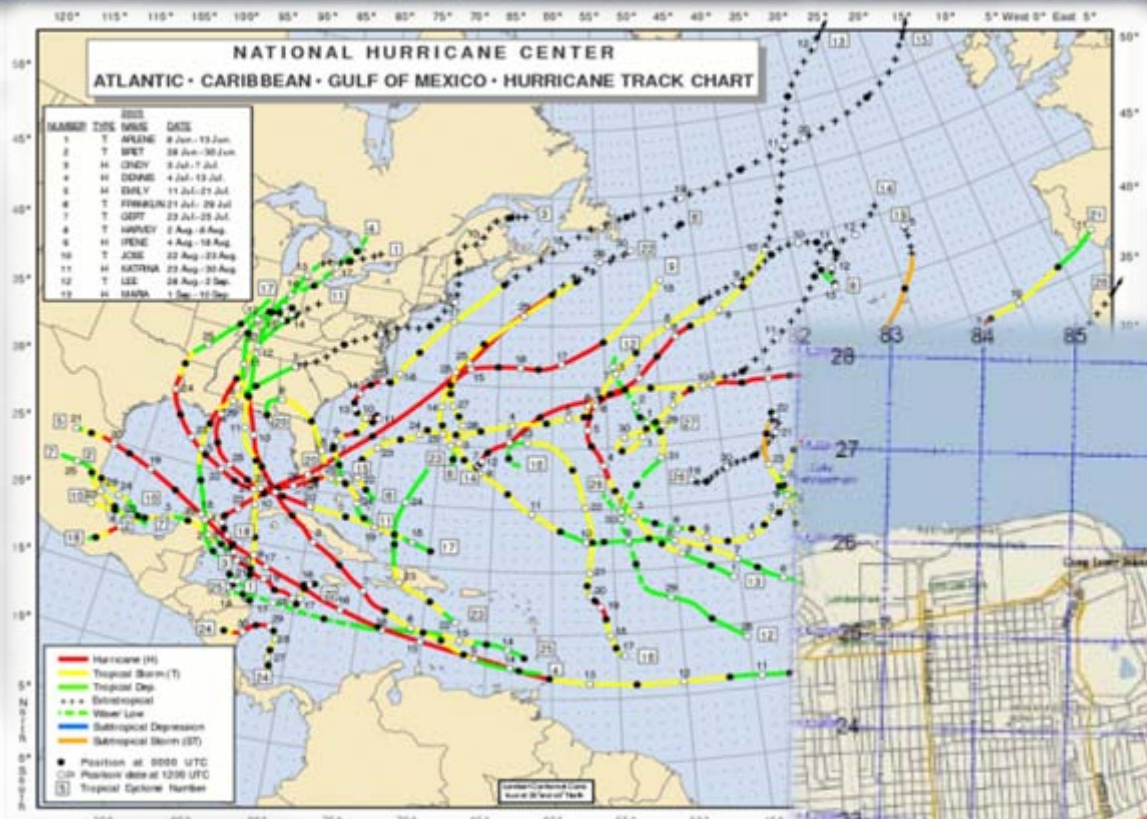
Facility Type	Emer_Funct	Name	Address1	City	County	Zip	USNG
FIRE STATIONS	ES	MIAMI BEACH FD ST 1	1051 JEFFERSON AVE	MIAMI BEACH	086	33139	17R NJ 86520 51740
LAW ENFORCEMENT	ES	MIAMI BEACH POLICE DEPT	1100 WASHINGTON AVE	MIAMI BEACH	086	33139	17R NJ 86945 51875
CALL CENTER	ES	MIAMI BEACH POLICE DEPT	1100 WASHINGTON AVE	MIAMI BEACH	086	33139	17R NJ 86945 51875

Cross Discipline – Cross Jurisdiction

- Scalable
- **Cross-Discipline**
- Common Operational Picture

Super Bowl XLI Search and Rescue Branch

Common Grid – Unified Response



Common Location Language

- The USNG is the operational equivalent to the Military Grid Reference System (MGRS)
- USNG & MGRS values are identical when referenced to WGS84 or NAD83 datum's
- Standard used by Department of Defense ground forces, who will be a significant catastrophic incident responder including CIS

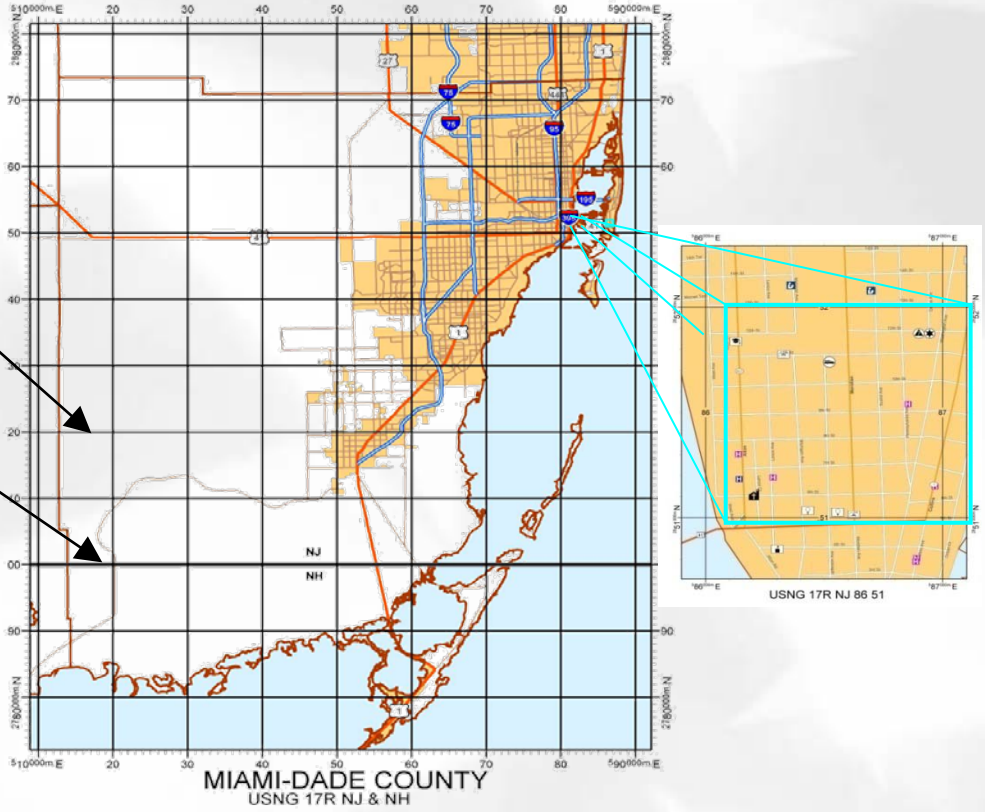
Largest Force Multiplier

- Soldiers are trained to utilize the Military Grid Reference System (MGRS) w/precision
- National Guardsmen can integrate seamlessly with their federal counterparts and other trained responders when joint responses are warranted.

USNG-based Situational Awareness

10,000 m Grid

100,000 m Grid



Operationalizing

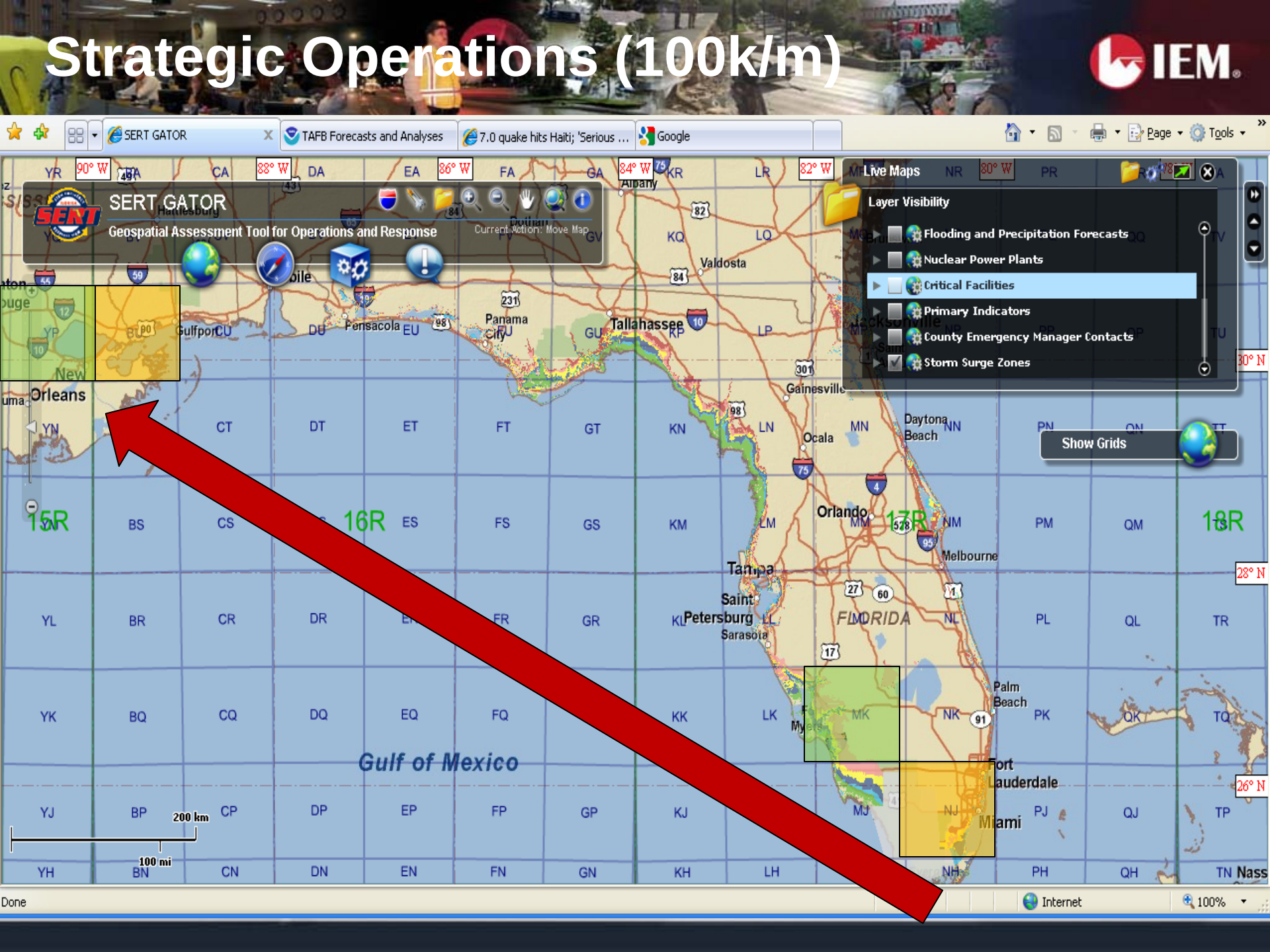
- Command & Coordination
- Situational Awareness
- Mission-based Required Resource Planning
- Pre-scripted Mission Development

USNG: Operational Areas

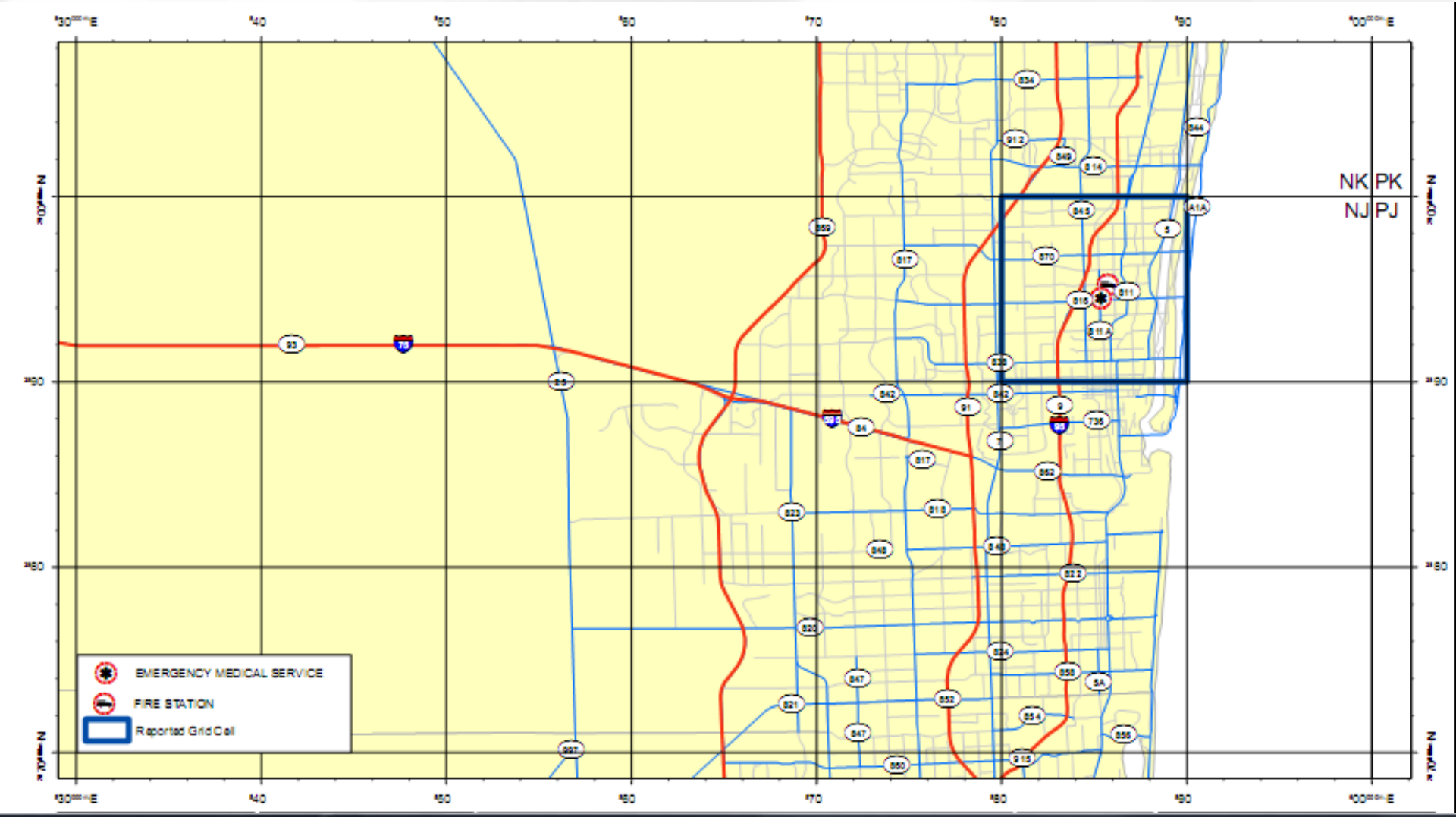
Catastrophic Planning & Response

The US National Grid, which allows for both point and area referencing, will be used for designating ground based areas of operation. . . . The scalable nature of the grid also allows for defining levels of operation such as strategic, regional and tactical. 100,000m grid cells will be used to designate strategic operational areas, 10,000m areas for regional operations, and 1,000m grid cells are used for tactical missions

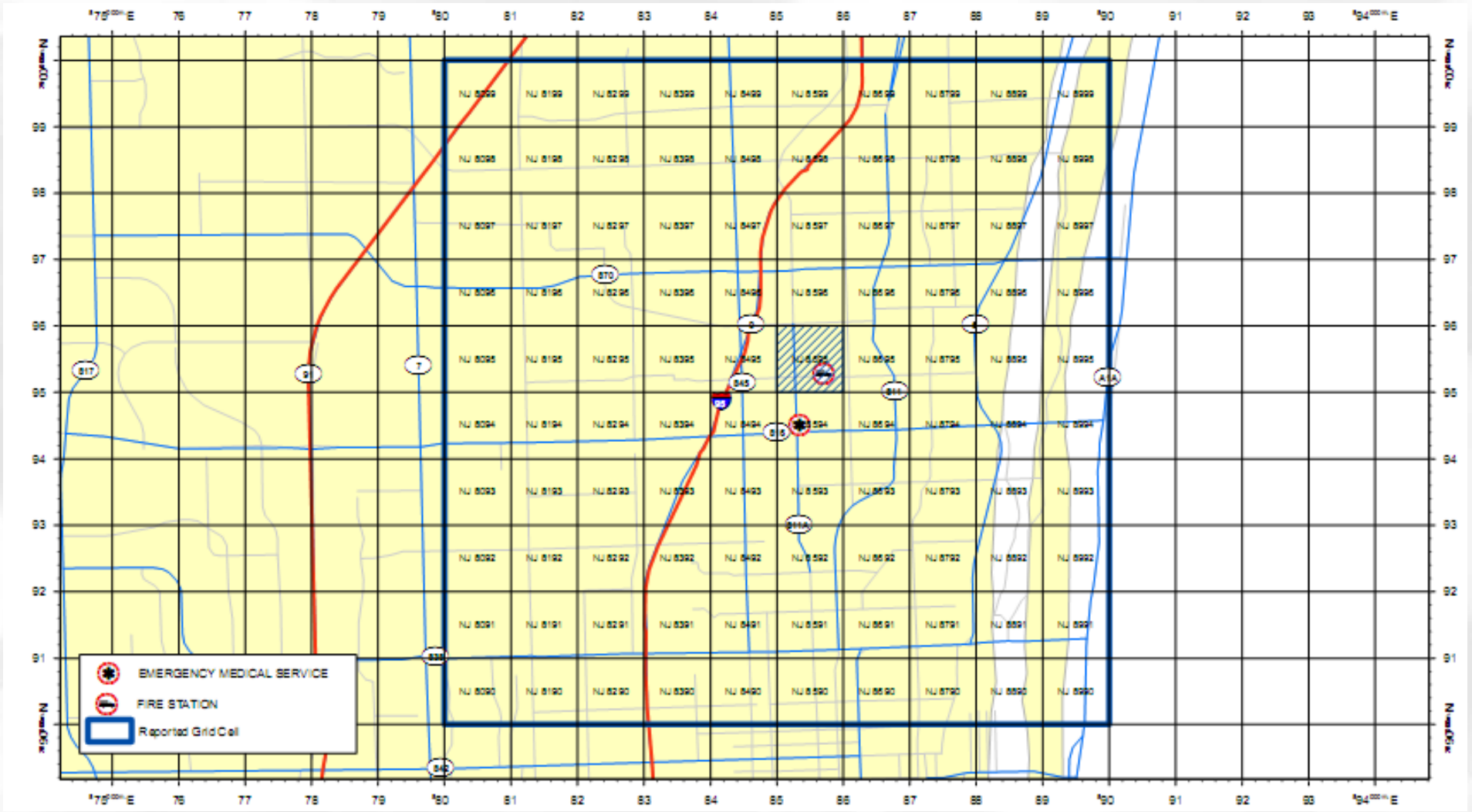
Strategic Operations (100k/m)



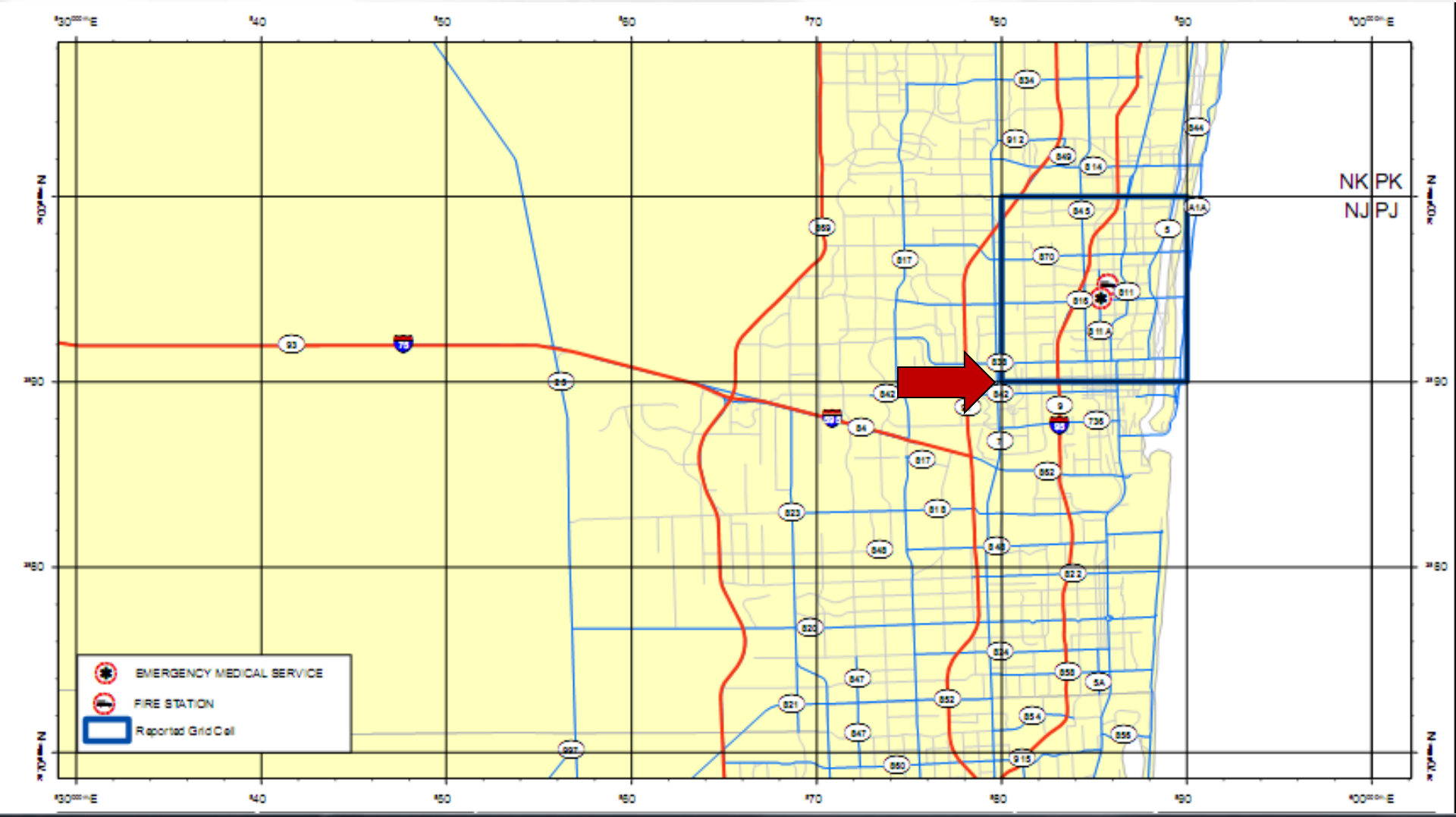
Regional Operations (10k/m)



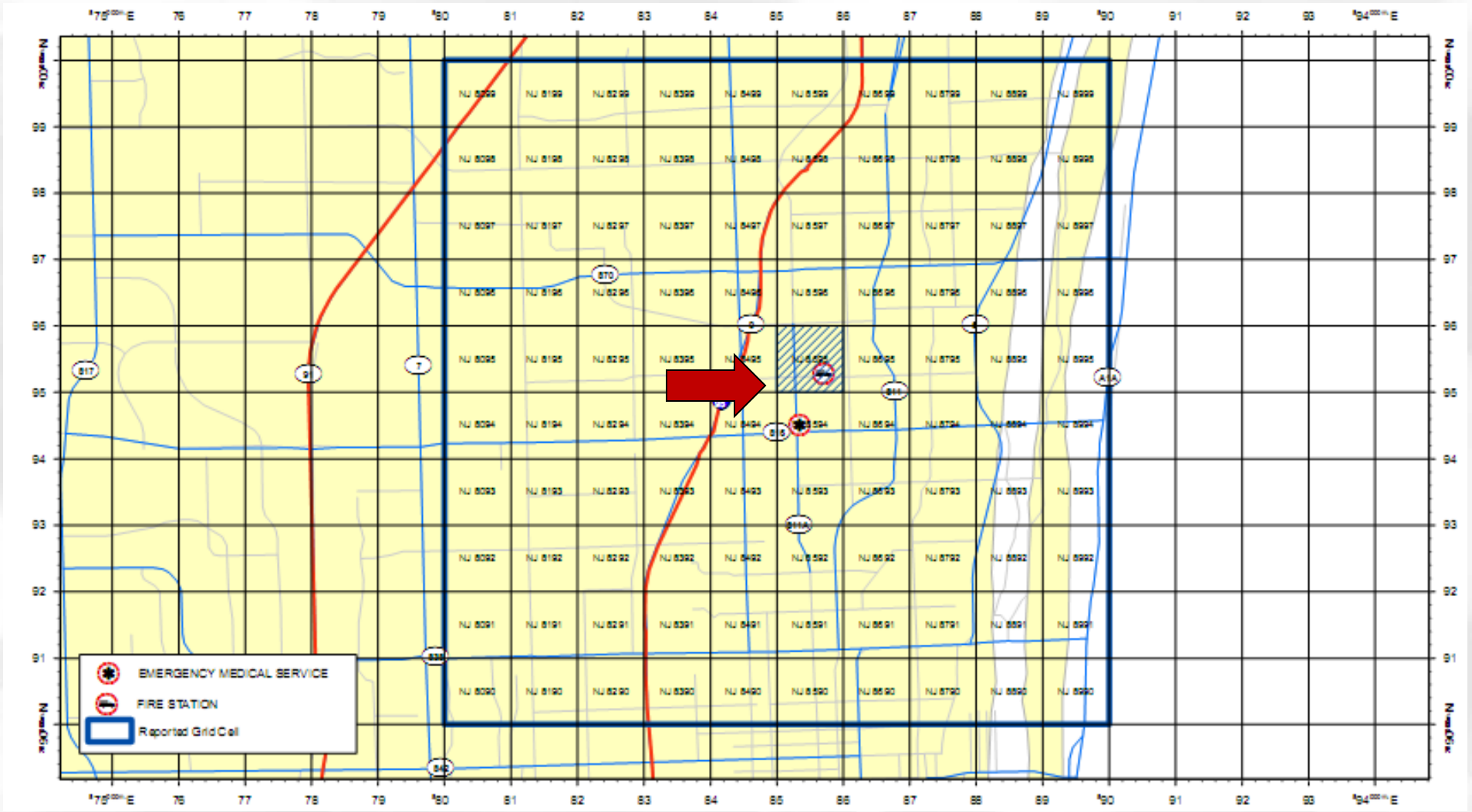
Tactical Operations (1k/m)



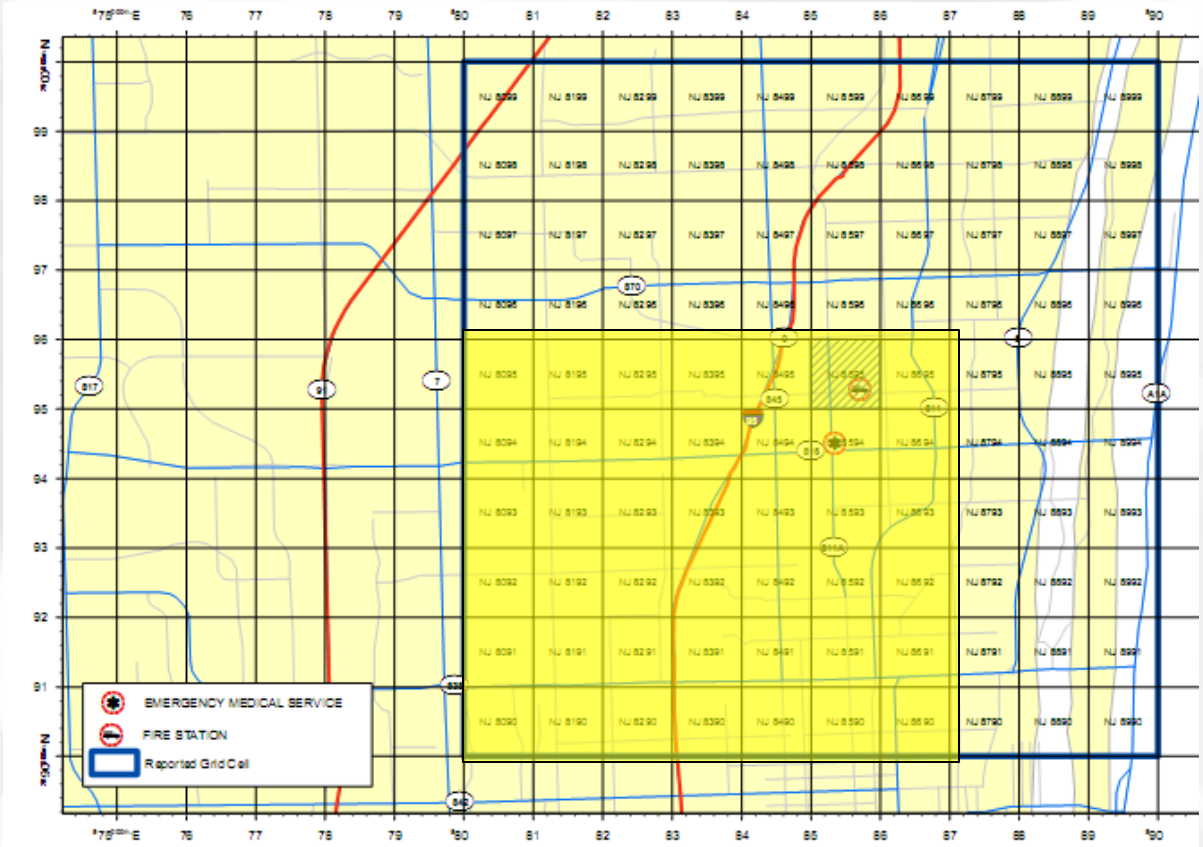
Try It – 10,000m Square



Try It – 1,000m Square



Calculate Progress

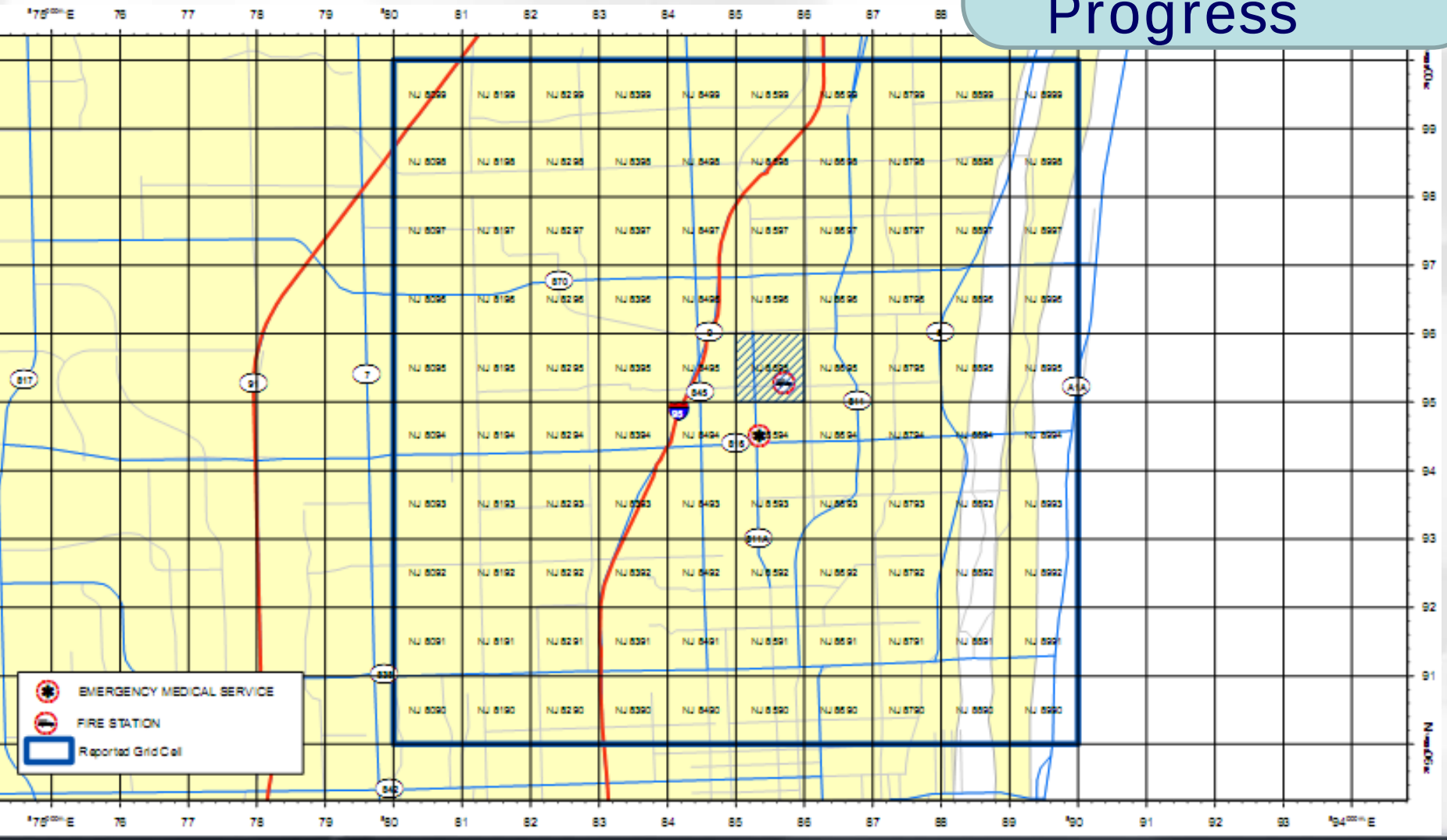


- 17R NJ 8090
- Primary SAR - 42 % Complete

Situational Awareness

Try It . . .

- Monitor Progress



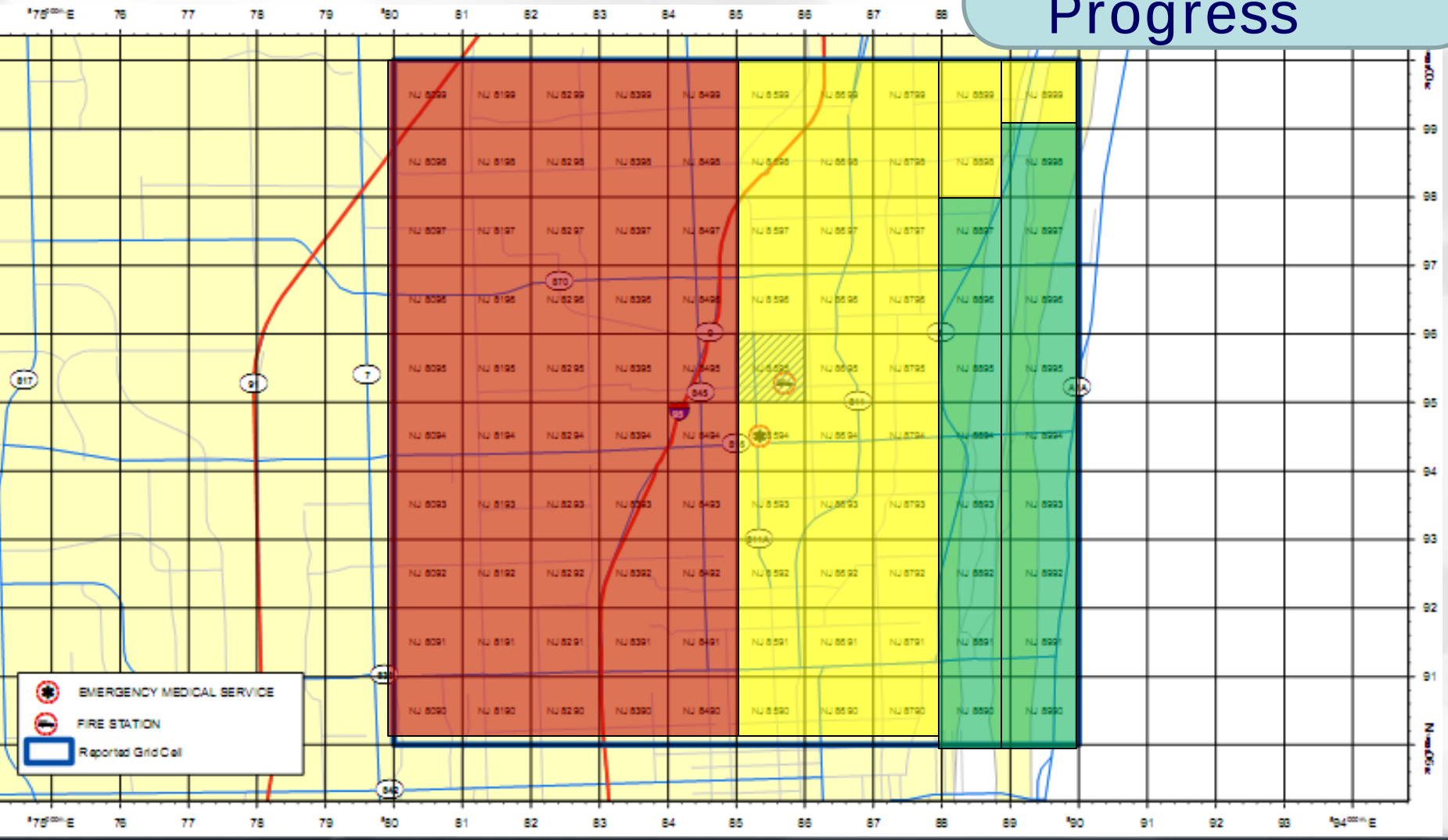
- Search & Rescue Completed
  - 17R NJ 8890 thru 17R NJ 8897
  - 17R NJ 8990 thru 17R NJ 8998
- Primary Search & Rescue is Completed
  - 17R NJ 8590 thru 17R NJ 8599
  - 17R NJ 8690 thru 17R NJ 8699
  - 17R NJ 8790 thru 17R NJ 8799
  - 17R NJ 8898 thru 17R NJ 8899
  - 17R NJ 8999

- Not Yet Searched
  - 17R NJ 8090 thru 17R NJ 8099
  - 17R NJ 8190 thru 17R NJ 8198
  - 17R NJ 8290 thru 17R NJ 8299
  - 17R NJ 8390 thru 17R NJ 8399
  - 17R NJ 8490 thru 17R NJ 8499

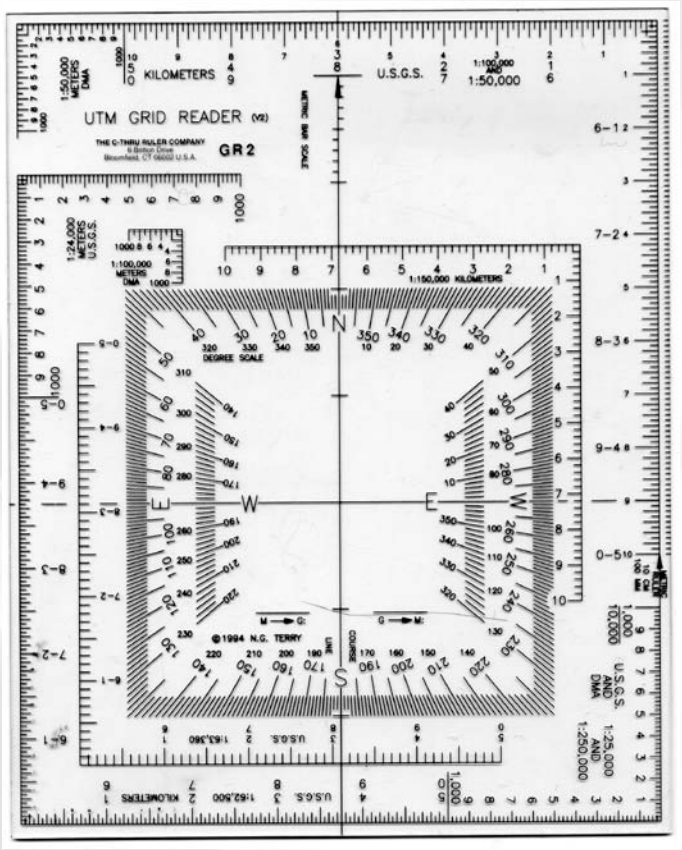
Situational Awareness

Try It . . .

- Monitor Progress

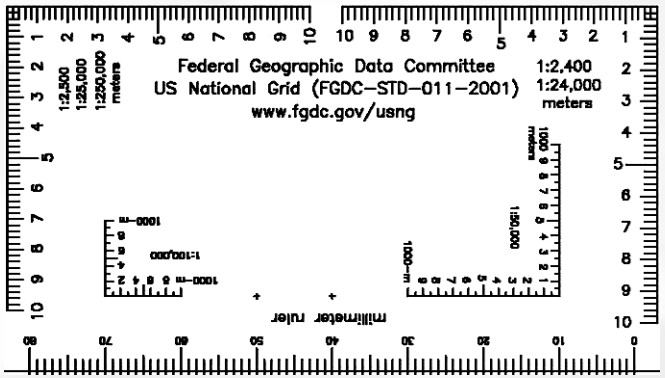


Reading the USNG – The Basics



Read Right,

Then Up.



Longitude/Latitude

- What's the distance between degrees?
  - Distance between Degrees (111 km)
- How far is a minute anyway?
  - Distance between minutes (30m)
- AT THE EQUATOR

Degrees/Minutes/Seconds

- What is the distance from . . . .
  - 85 59’24.545”W, 30 16’20.063”N
- To here….
  - 85 59’26.292”W, 30 16’14.546”N

Mixed Formats

- Worse…what is the distance from….
  - -85.990443, 30.275358
- To here….
  - 85 59.364547, 30 16.504539

Field Conversion

Try It . . .

- 29.99777
- -82.09416

Decimal Degrees to DD MM SS

- **-85.990151** subtract whole number (85)

  and multiply remainder by 60

  - .990151 X 60 = 59.4096

- **59**.4096 subtract whole number (59)

  and multiply remainder by 60

  - .4096 X 60 = **24.576**

DD MM SS = **85 59 24.576 S**

Field Conversion

Try It . . .

- N29 59’ 52”
- W82 05’ 32”

From DD MM SS to Decimal Degrees

– Divide the number of seconds

85 59 **24.576** S by 60 (24.576/60 = .4096)

– Add the quotient to above

- 85 **59.4096**

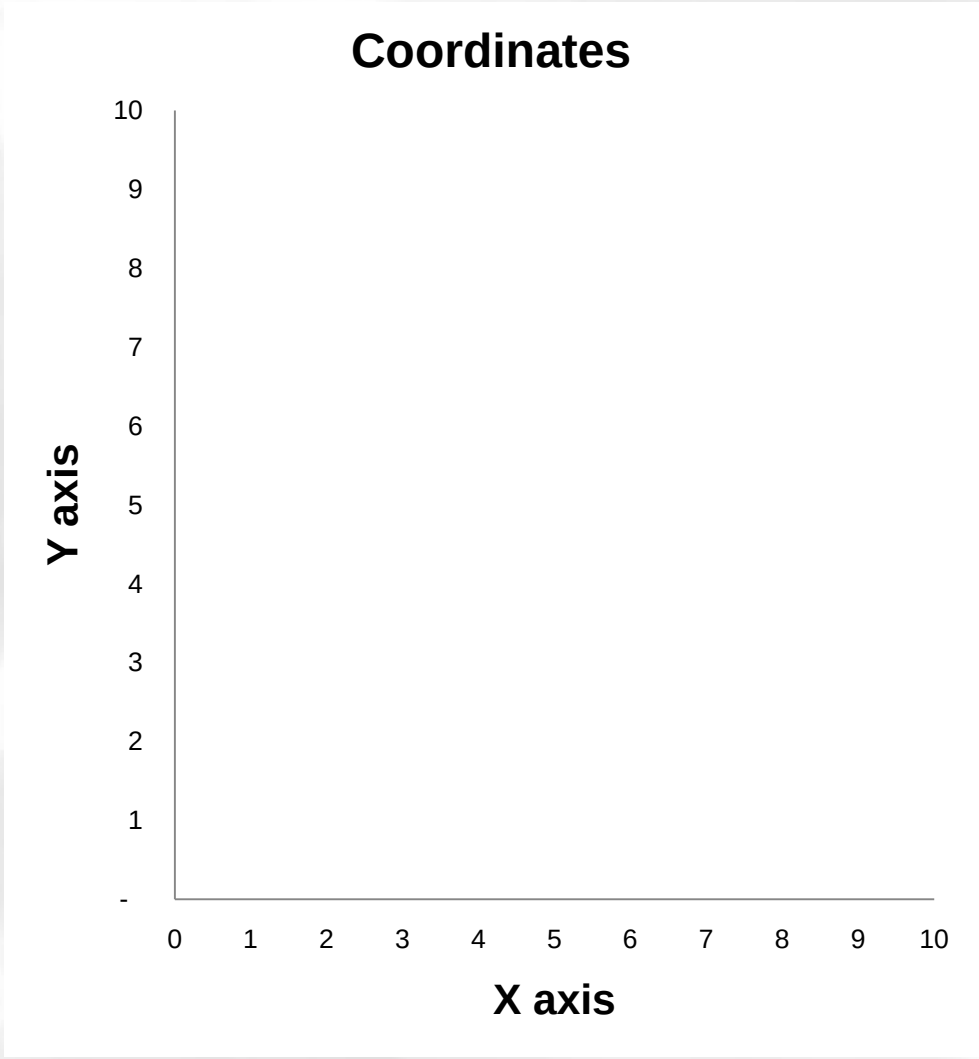
– Divide the number of decimal minutes by 60

- 59.4096/60= .99016

– Add the quotient to above

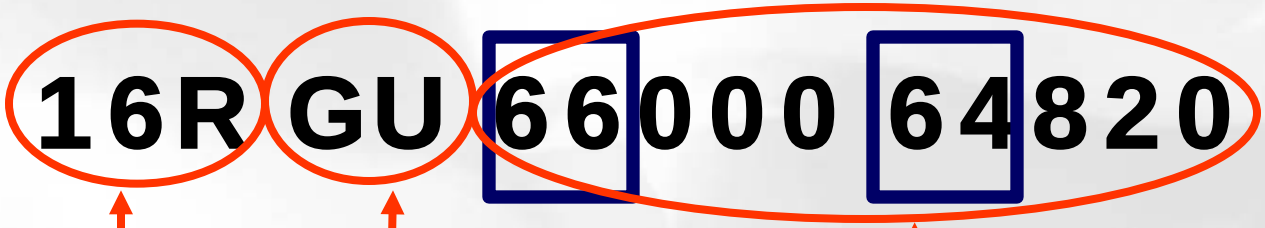
Decimal Degrees = -85.99016

Coordinate Basics



- **A common example you might remember from geometry**
- **Classic Cartesian**

Primary Components



Grid Zone Designation – for a world-wide unique address, identifies the longitude zone number and the latitude band letter

100,000 Meter Grid – identification for regional areas

Grid Coordinates – Easting and Northing position

Three Components

- **Three components make up a USNG Coordinate**
  - Grid Zone Designation
  - 100,000m Square ID
  - Coordinate pair

1	2	3	
GZD	100,000m	Easting	Northing

Primary Components

16R GU 66000 64820

Grid Zone Designation – for a world-wide unique address, identifies the longitude zone number and the latitude band letter

100,000 Meter Grid – identification for regional areas

Grid Coordinates – Easting and Northing position

Precision

- Coordinates are represented in pairs

1	2	3	
GZD	100,000m	6103	7043

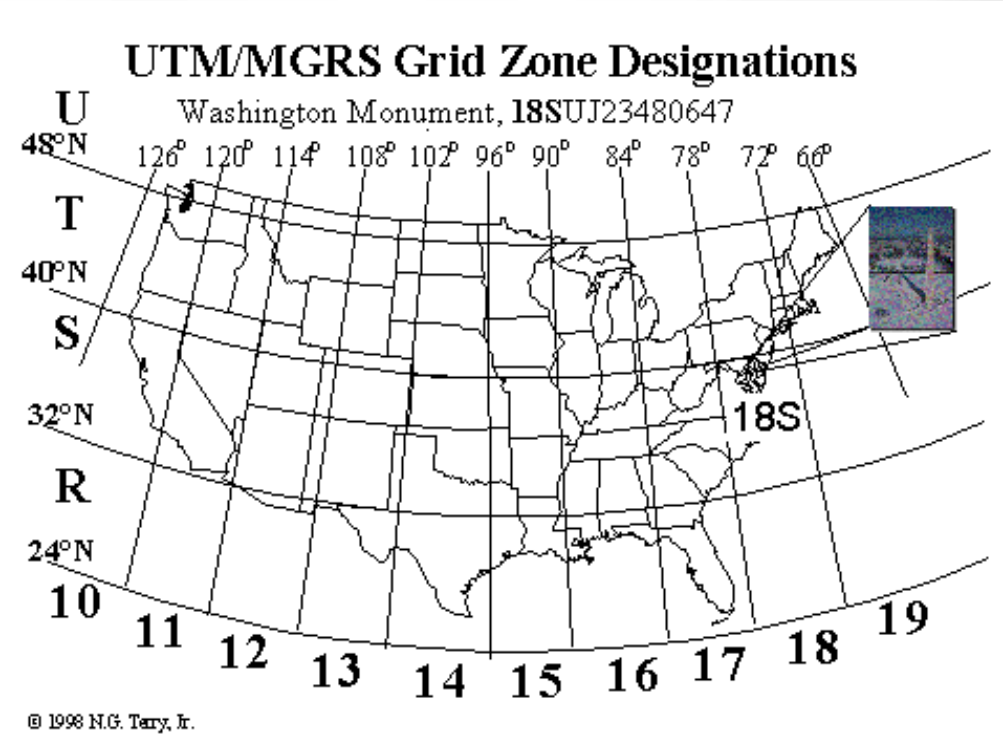
- Number of digits determine precision
- 16RGU61 07 – 4 digits = 1km
- 16RGU610 704 – 6 digits = 100m
- 16RGU6103 7043 – 8 digits = 10m
- 16RGU61031 70436 – 10 digits = 1

Remember…

- Coordinates are always given as an even number of digits (ie. 55905 74965)
- Separate coordinates in half (55905 74965) into the easting and northing components.
- Read right to grid line 55. Then measure right another 905-m
- Read up to grid line 74. Then measure up another 965 –m

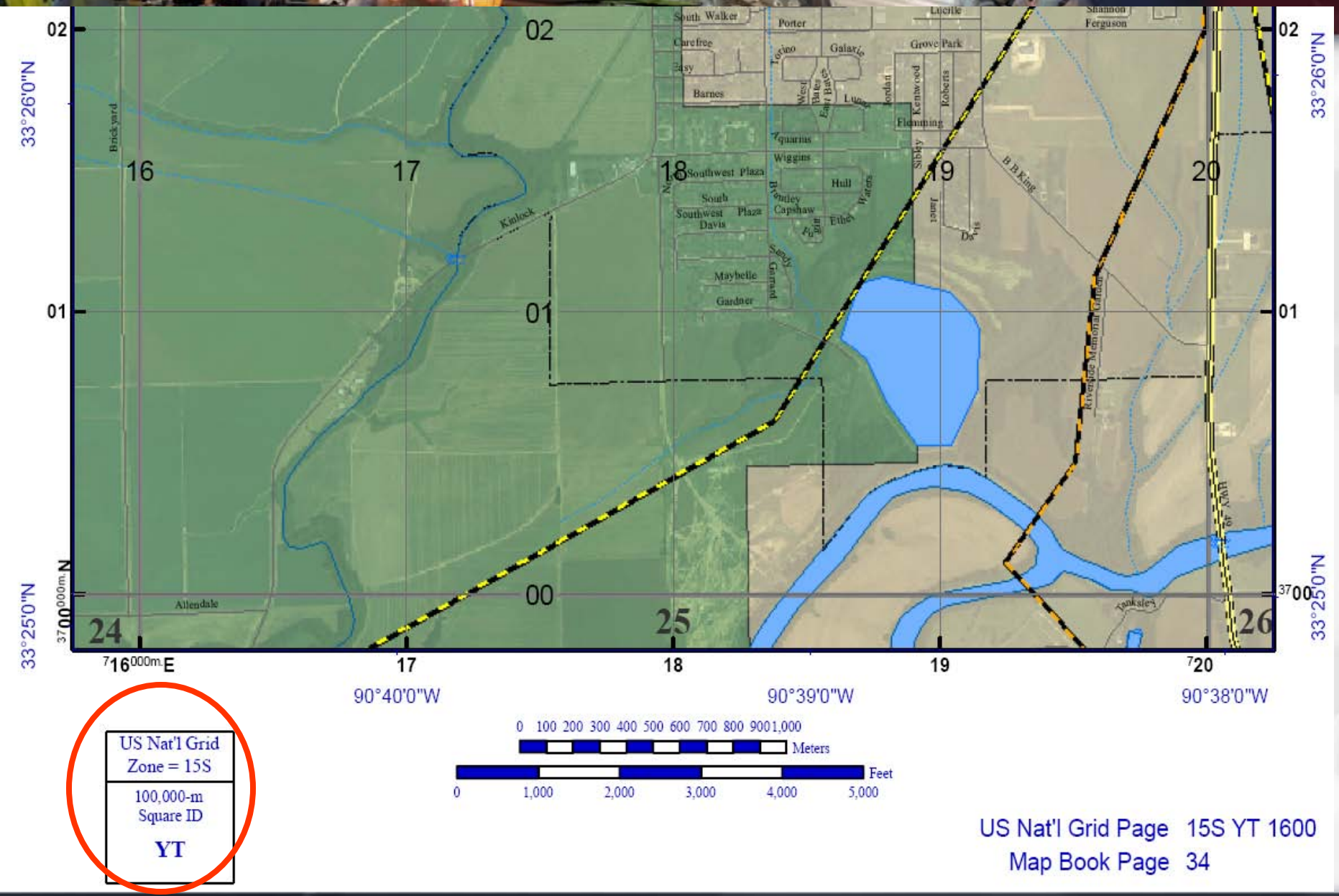
Grid Zone Designation

Step 1: Determine the USNG Grid Zone



- Unique alphanumeric label
- 6 degrees longitude
- 8 degrees latitude
- Each zone is further divided into 100,000m squares

Grid Zone Designation



US Nat'l Grid
Zone = 15S

100,000-m
Square ID

YT

0 100 200 300 400 500 600 700 800 900 1,000 Meters

0 1,000 2,000 3,000 4,000 5,000 Feet

US Nat'l Grid Page 15S YT 1600

Map Book Page 34

100,000 m Square ID

Step 2: Determine the 100,000-m Square ID

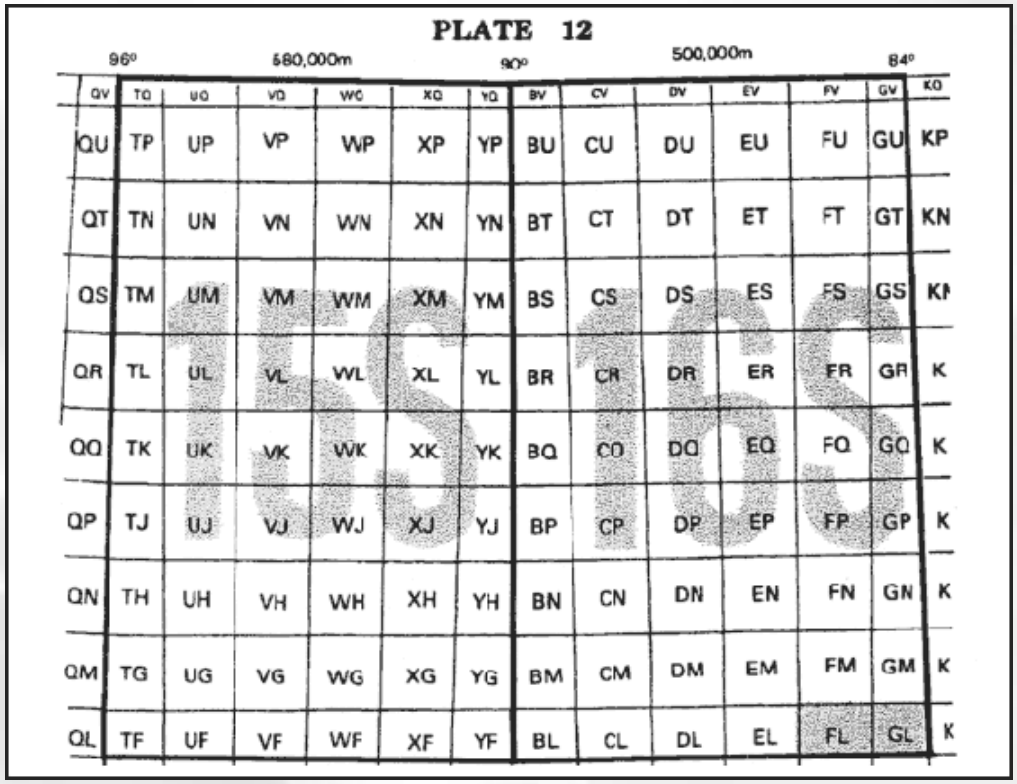


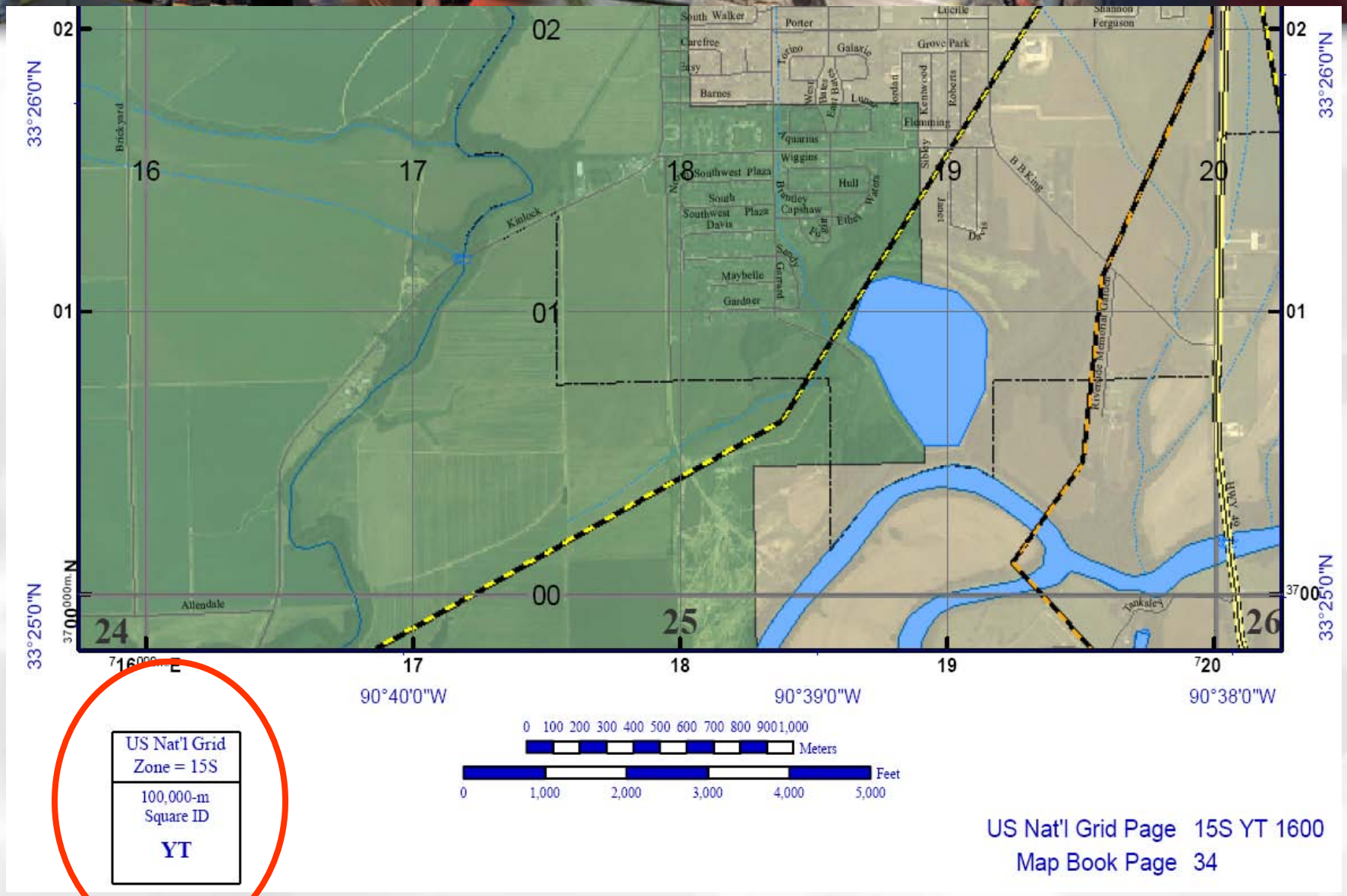
PLATE 12

96° 580,000m 90° 500,000m 84°

QV	TQ	UQ	VQ	WQ	XQ	YQ	BV	CV	DV	EV	FV	GV	KQ
QU	TP	UP	VP	WP	XP	YP	BU	CU	DU	EU	FU	GU	KP
QT	TN	UN	VN	WN	XN	YN	BT	CT	DT	ET	FT	GT	KN
QS	TM	UM	VM	WM	XM	YM	BS	CS	DS	ES	FS	GS	KM
QR	TL	UL	VL	WL	XL	YL	BR	CR	DR	ER	FR	GR	K
QQ	TK	UK	VK	WK	XK	YK	BQ	CQ	DQ	EQ	FQ	GQ	K
QP	TJ	UJ	VJ	WJ	XJ	YJ	BP	CP	DP	EP	FP	GP	K
QN	TH	UH	VH	WH	XH	YH	BN	CN	DN	EN	FN	GN	K
QM	TG	UG	VG	WG	XG	YG	BM	CM	DM	EM	FM	GM	K
QL	TF	UF	VF	WF	XF	YF	BL	CL	DL	EL	FL	GL	K

100,000m Square ID

- Two character alpha designation
- This two letter pair is known as the 100,000m square identification



US Nat'l Grid
Zone = 15S

100,000-m
Square ID

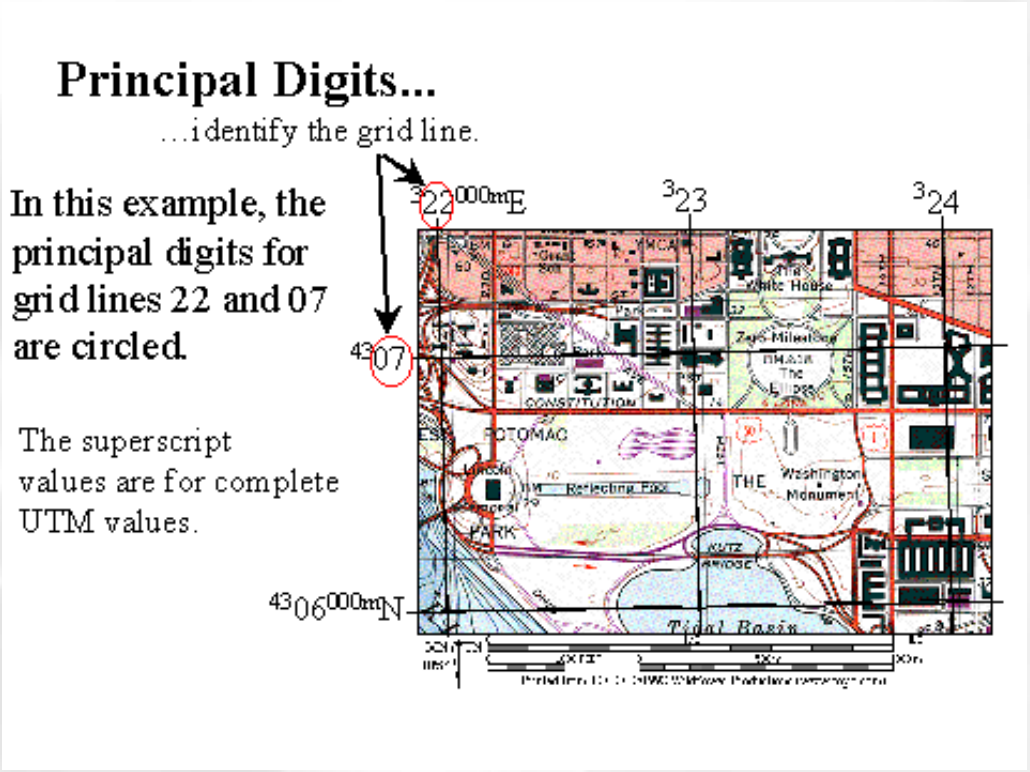
YT

US Nat'l Grid Page 15S YT 1600

Map Book Page 34

Principal Digits

Step 3: Determine Principal Digits



- 1000m gridlines are typically printed on field maps 1:100,000 or larger
- Coordinates for 1000m gridlines are known ad Principal Digits
- Represented in larger type
- Full UTM value must be shown at least once on the map

Principal Digits

Try It…

- **Match the components with the USNG Coordinate**

___18S	A. Grid Coordinate
___UJ	B. Grid Zone Designation
___234064	C. Principal Digits
___23 06	D. 100,000m Square ID

Try It…

Which of the following represents a USNG coordinate to 100m precision?

A. 16RGU6074

B. 16RGU6013274633

C. 16RGU60137463

D. 16RGU601746

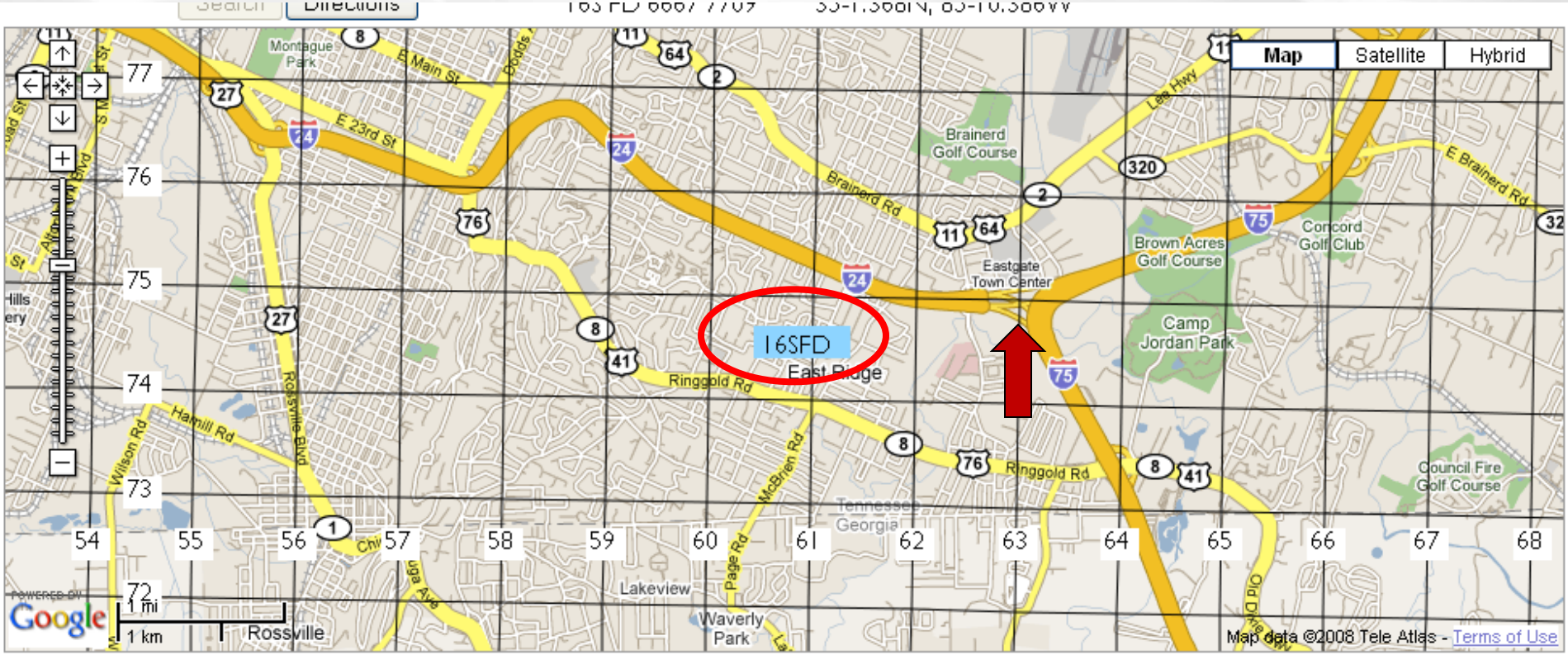
Three Components

- **Three components make up a USNG Coordinate**
  - Grid Zone Designation
  - 100,000m Square ID
  - Coordinate pair

1	2	3	
GZD	100,000m	Easting	Northing

Reading USNG Coordinates

- Grid Zone Designation (GZD) = 16S
- 100,000m Square ID = FD
- Coordinate Pair = Read Right (63) Then Up (75)

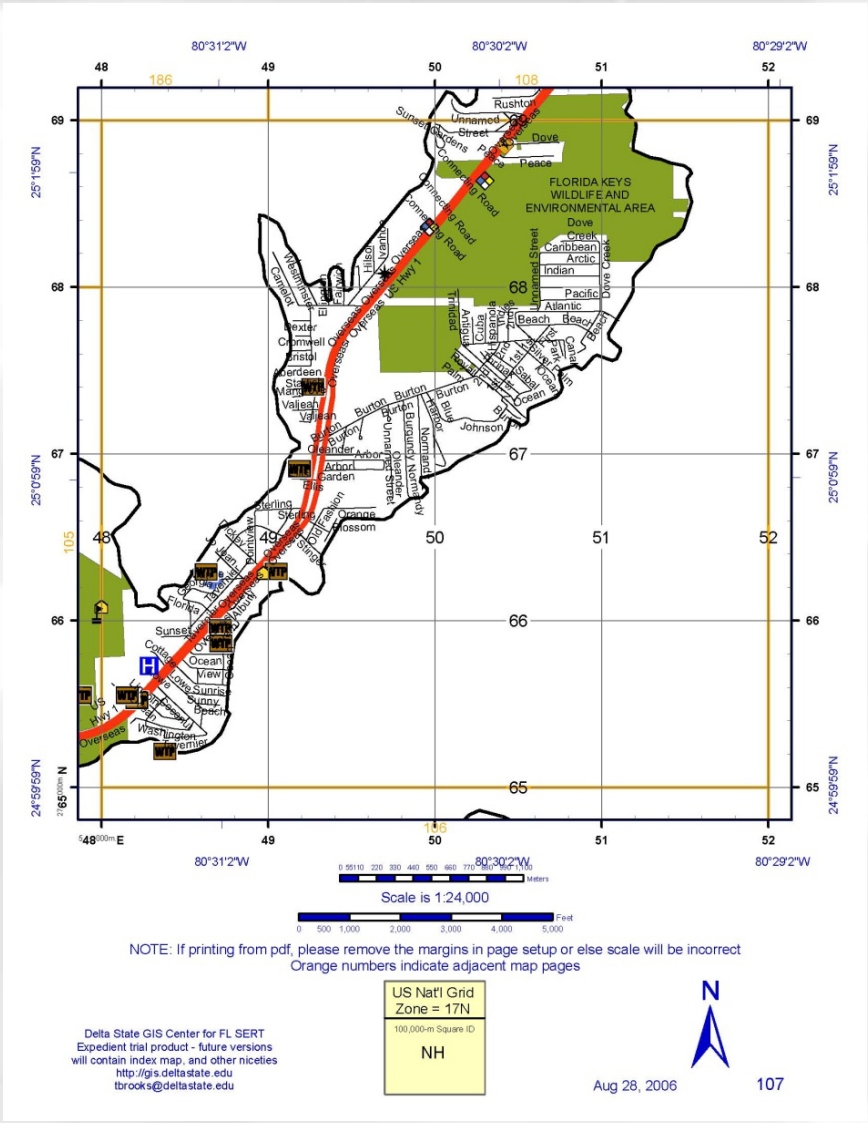


Try It…

- **Match the components with the USNG Coordinate**

___18S	A. Grid Coordinate
___UJ	B. Grid Zone Designation
___234064	C. Principal Digits
___23 06	D. 100,000m Square ID

Right then Up



Reading right (east) then up (north) will identify the coordinate pair. Coordinate pairs represent the easting and northing for a given location.

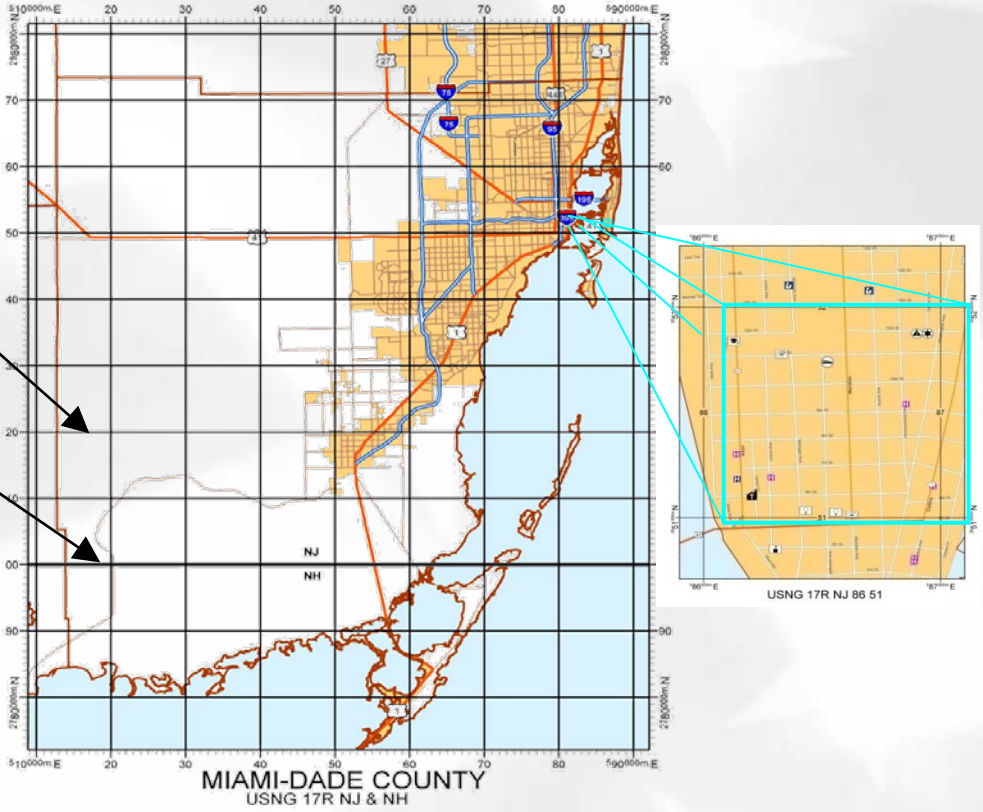
Easting and Northing gridlines are identified by Principal Digits

To begin determining USNG coordinates for the target – find the intersecting easting and northing gridlines nearest your target

USNG-based Pre-Scripted Missions

10,000 m Grid

100,000 m Grid



Lessons Learned – Required Resource Planning

Structures per Strike Teams per Op Period	500
Hours per Day	12
Structures per Strike Team per Day	500

Hours Allowed	24
Deployment Time	6
Hours Available	18

County	Structures	Strike Teams	Personnel
Miami-Dade	352,332	940	18,800
Broward	335,252	895	17,900
Palm Beach	293,881	784	15,680
Martin	8,368	23	460
Okeechobee	6,185	17	340
Hendry	5,916	16	320
Glades	3,134	9	180
Lee	408	2	40
Monroe	50	1	20
Total	1,005,526	2,687	53,740

Pre-Scripted Missions

- Identify potential missions within a grid
  - Demographics, infrastructure, hazards
  - Multi-disciplinary missions
- Establish resource requirements
  - Based on scenario based planning
  - Based on pre-event forecasts
  - Revise based on post event damage intelligence
- Facilitates pre-arrival planning by command and staged or deployed resources

Goal: **Determine mission based required resources and pre-script missions based on USNG analysis**

- **Overlay basic data layers with USNG**
  - Demographic data
  - Critical Infrastructure Datasets

Demographics

Population for USNG 17S NJ 8651

Number of Census Blocks	Total Population	Male Under 5	Male Over 65	Female Under 5	Female Over 65	HH Income Under 20,000	HH Non-auto Owning	Non-English Speaking	Number of HH in Grid	Avg HH Size in Grid
88	14440	618	933	590	1452	3240	3782	13251	8956	1.33

Community Resources for USNG 17S NJ 8651

Facility Type	Emer_Funct	Name	Address1	City	County	Zip	USNG
FAITH-BASED FACILITY	CR	SAINT FRANCIS DE SALES CHURCH		MIAMI	086		17R NJ 86203 51109

Education for USNG 17S NJ 8651

Facility Type	Emer_Funct	Name	Address1	City	County	Zip	USNG
COLLEGE	ED	YESHIVA GEDOLAH RABBINICAL COLLEGE	1140 ALTON RD	MIAMI BEACH	086	33139	17R NJ 86128 51838

Energy for USNG 17S NJ 8651

Facility Type	Emer_Funct	Name	Address1	City	County	Zip	USNG
FUEL FACILITIES - ALONG EVACUATION ROUTES	ENR	8506091		MIAMI BEACH	86		17R NJ 86558 51024
FUEL FACILITIES - ALONG EVACUATION ROUTES	ENR	8504579		MIAMI BEACH	86		17R NJ 86430 51032

Critical Facilities

Health Care for USNG 17S NJ 8651

Facility Type	Emer_Funct	Name	Address1	City	County	Zip	USNG
HOSPITAL	ES	SOUTH BEACH COMMUNITY HOSPITAL	630 ALTON ROAD	MIAMI BEACH	86	33139	17R NJ 86141 51183
CLINICAL LABORATORY	ES	MIAMI BEACH COMMUNITY HEALTH CENTER	710 ALTON ROAD	MIAMI BEACH	86	33139	17R NJ 86138 51302
CLINICAL LABORATORY	ES	MIAMI DADE COUNTY HEALTH DEPT / LAB SERV	615 COLLINS AVENUE	MIAMI	86	33139	17R NJ 86966 51150
RESIDENTIAL TREATMENT FACILITY	ES	DOUGLAS GARDENS C.M.H.C./ CRISIS RESIDEN	629 LENOX AVENUE	MIAMI BEACH	86	33139	17R NJ 86284 51191
SKILLED NURSING FACILITY	ES	OCEANSIDE EXTENDED CARE CENTER	550 9TH STREET	MIAMI BEACH	86	33139	17R NJ 86853 51538

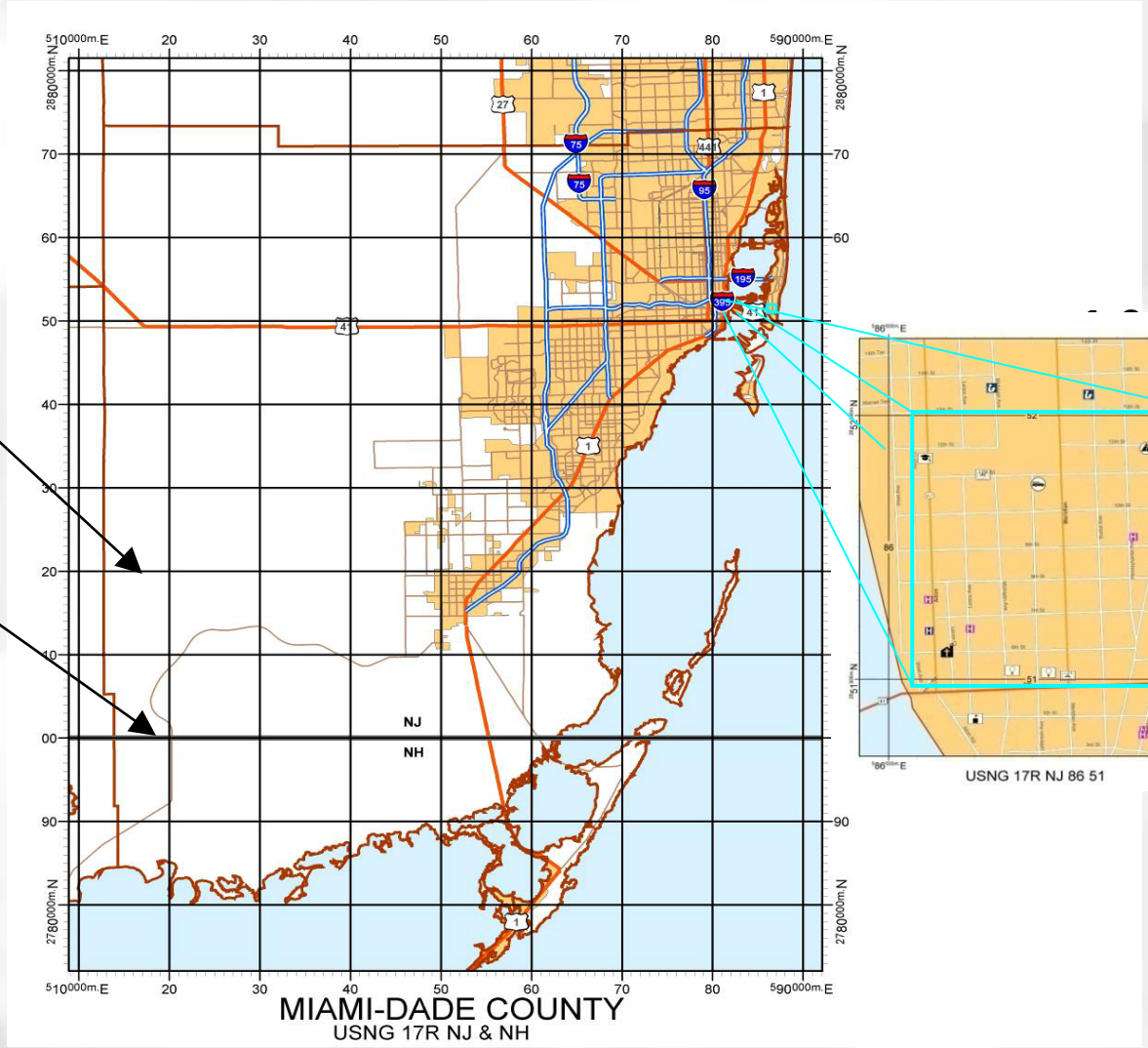
Emergency Services for USNG 17S NJ 8651

Facility Type	Emer_Funct	Name	Address1	City	County	Zip	USNG
FIRE STATIONS	ES	MIAMI BEACH FD ST 1	1051 JEFFERSON AVE	MIAMI BEACH	086	33139	17R NJ 86520 51740
LAW ENFORCEMENT	ES	MIAMI BEACH POLICE DEPT	1100 WASHINGTON AVE	MIAMI BEACH	086	33139	17R NJ 86945 51875
CALL CENTER	ES	MIAMI BEACH POLICE DEPT	1100 WASHINGTON AVE	MIAMI BEACH	086	33139	17R NJ 86945 51875

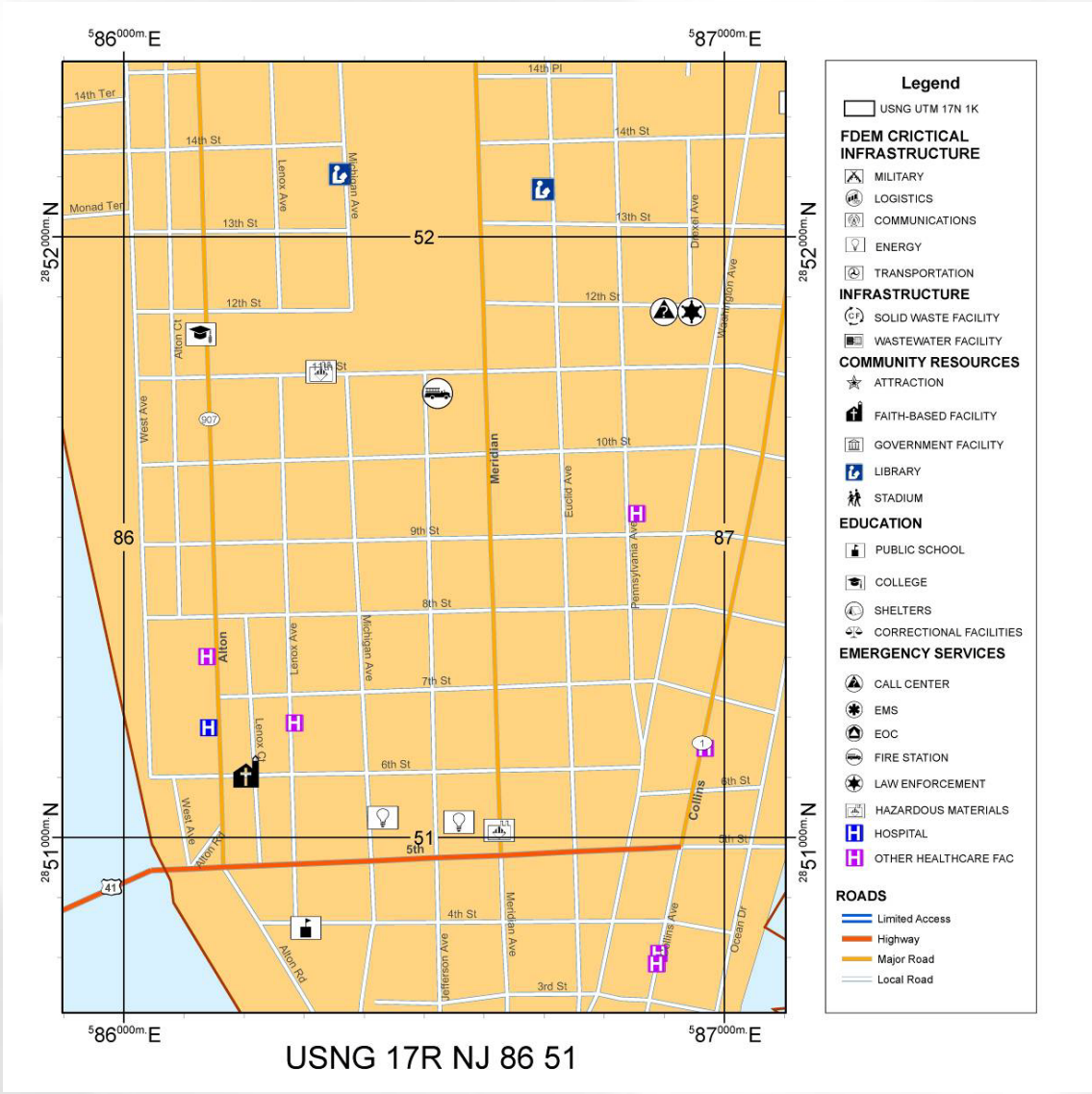
Data Layers

LAYER	CATEGORY	LAYER	CATEGORY
Population by Age (<5, 65+)	Demographics	Wind Damage by Category	Ono
Non-English Speaking Population	Demographics	Water Damage by Category	Ono
Households by Income level (<$15K/yr)	Demographics	Total Damage by Category	Ono
Transportation dependent (non-auto owning) Population	Demographics	Flooding (Water vs. Dry)	Ono
College student population	Demographics	Evacuees	Ono
Undocumented worker population/transient population	Demographics	Debris	Ono
Population needing consistent medical care	Demographics	Shelter Capacity	Sheltering
Homeless Population	Demographics	Pet-Friendly Capacity	Sheltering
Residential Buildings	Housing	Special Needs Capacity	Sheltering
Manufactured Housing	Housing	Businesses	Economics
High-rise	Housing	Small Businesses	Economics
Multi-family	Housing	Employees	Economics
Buildings by Year Built	Housing	Revenue	Economics
Housing Units	Housing	Search & Rescue	Staging Areas
Vacant Housing Units	Housing	Fuel	Staging Areas
Renter-Occupied Housing Units	Housing	Mass Care (Food/Shelter)	Staging Areas
Owner-Occupied Housing Units	Housing	Other Equipment	Staging Areas
Ports	Infrastructure	Households with Pets	Animals
Power Plants	Infrastructure	Cat Ownership	Animals
Health/Medical Sites	Infrastructure	Dog Ownership	Animals
Hospitals	Infrastructure	Livestock Ownership	Animals
Nursing Homes	Infrastructure	Navigable Waterways	
HazMat	Infrastructure	USAR Strike Teams by Level	Matrix
		USAR Personnel by Level	Matrix
		Vehicles (Diesel/Gas)	Matrix

1,000 m grid square in Miami-Dade County



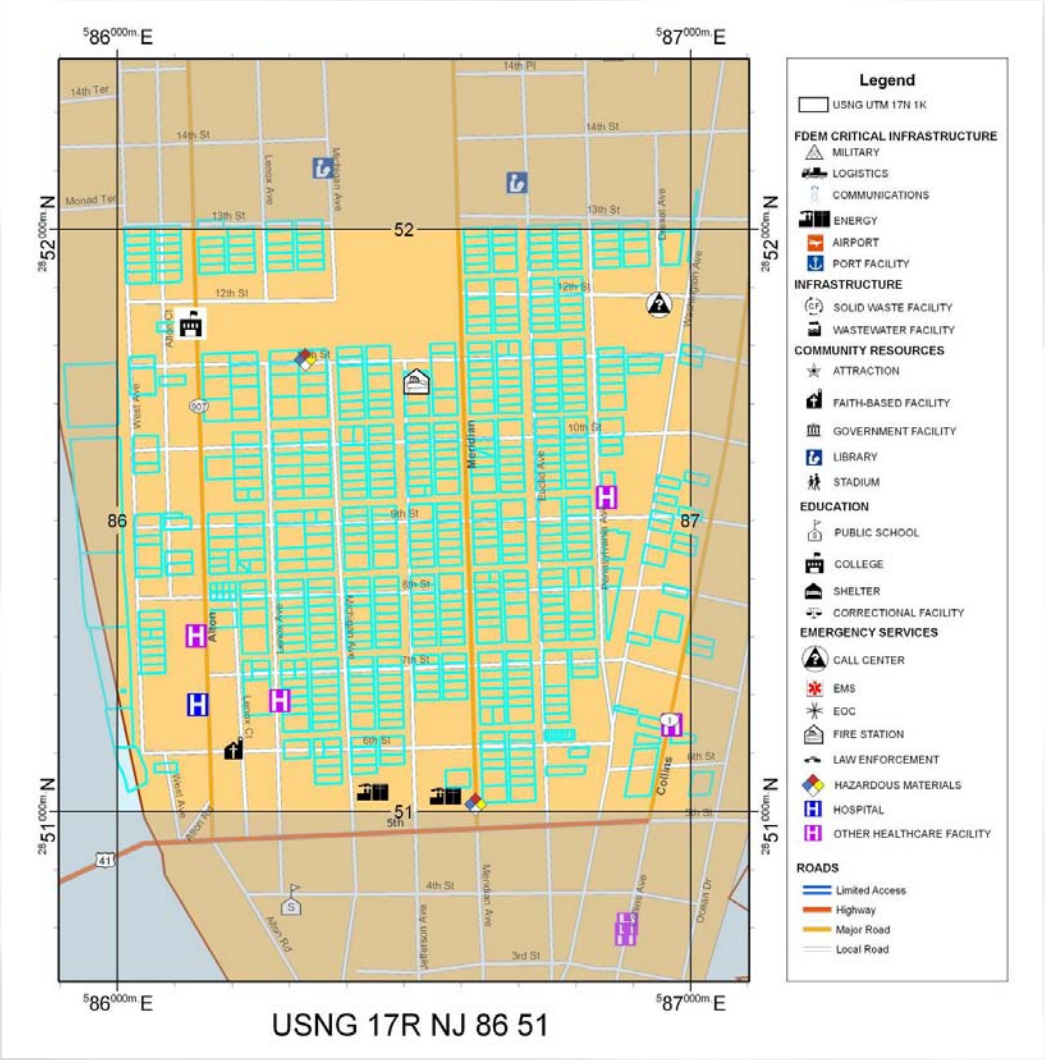
USNG: 1,000m Grid Example



USNG 17R NJ 86 51

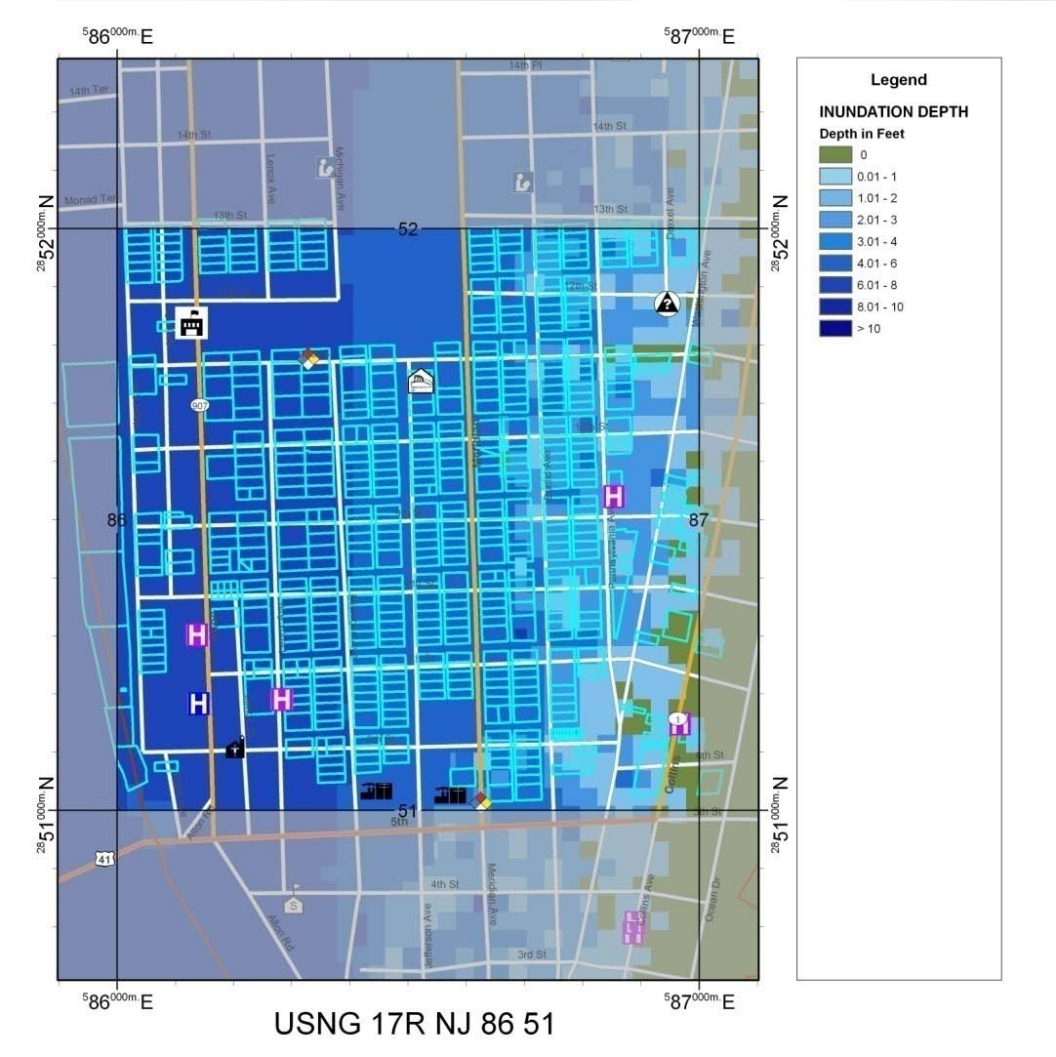
USNG: Parcel Analysis

1,000 m grid square overlaid with selected features



USNG: Flood Analysis

17S NJ 8651 with Storm Surge Inundation Depths



Mission Planning

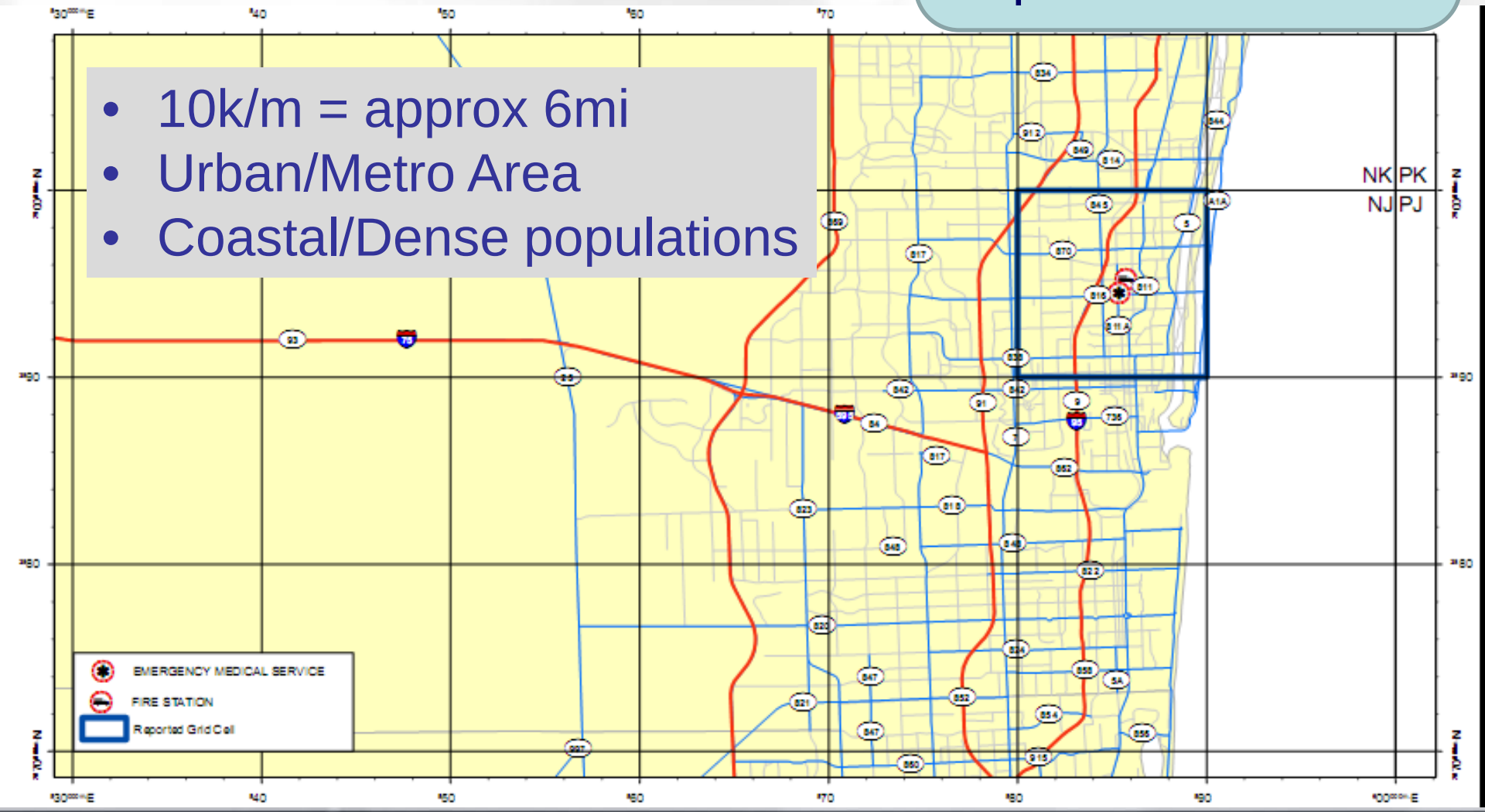
- **Mission/Task**
- **Outcome**
- **Required Resources**
  - Human Resources
  - Equipment
- **Plan of Action**

Mission Planning

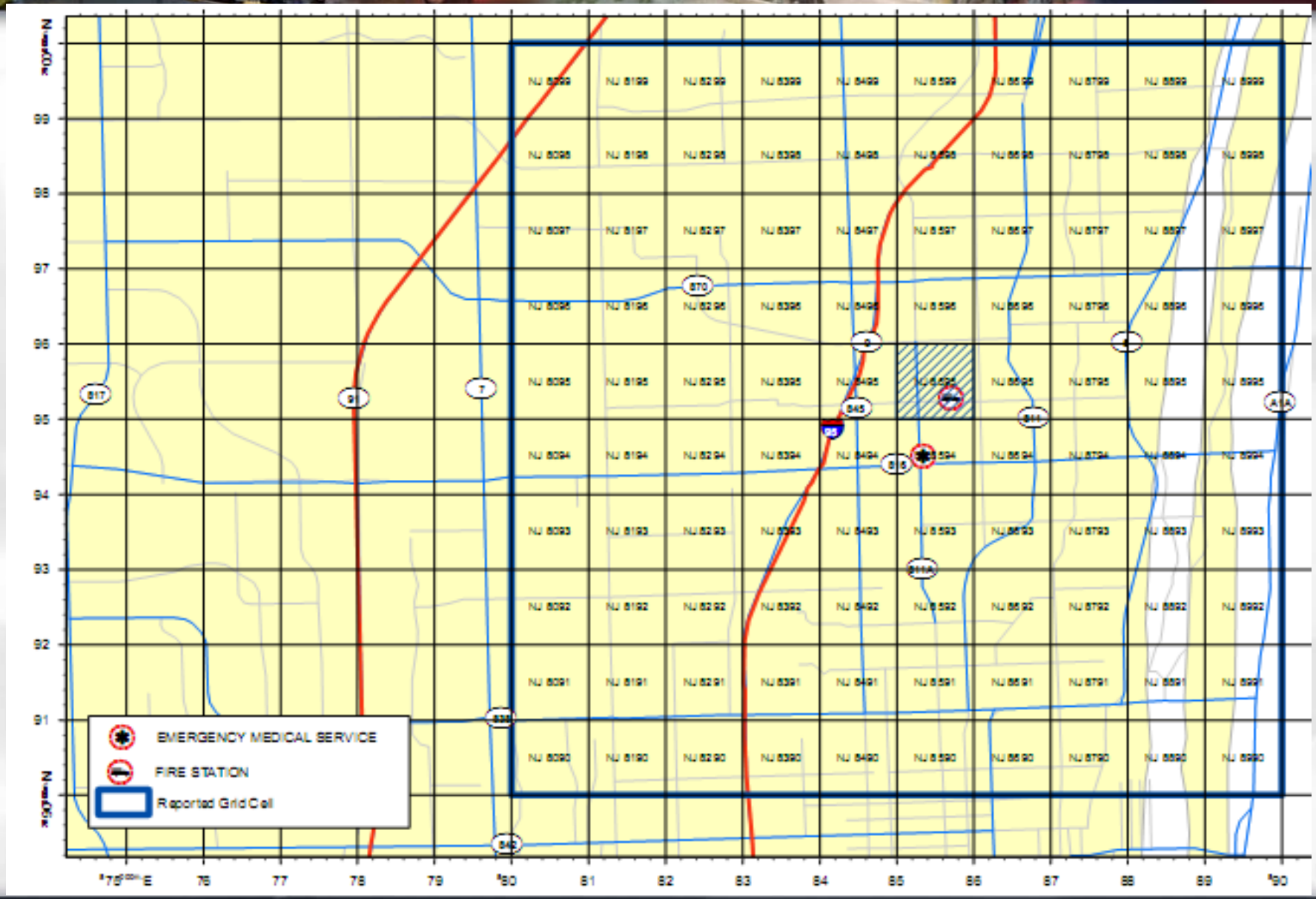
Try It . . .

- Define Operational Areas

- 10k/m = approx 6mi
- Urban/Metro Area
- Coastal/Dense populations



Pre-Script Mission Planning



Demographics

Total Population	Males Under 5	Males Over 65	Females Under 5	Females Over 65	HH Income Under 20k	HH Non-Auto Owning	Non-English Speaking	# of HH in Grid
14,440	618	933	590	1,452	3,240	3,782	13,251	8,956
15,280	654	987	624	1,536	3,428	4,002	14,022	7,640
12,345	528	798	504	1,241	2,770	3,233	11,329	6,173
18,675	799	1,207	763	1,878	4,190	4,891	17,137	9,338
12,376	530	800	506	1,244	2,777	3,241	11,357	6,188
16,923	724	1,093	691	1,702	3,797	4,432	15,530	8,462
14,123	604	913	577	1,420	3,169	3,699	12,960	7,062
19,320	827	1,248	789	1,943	4,335	5,060	17,729	9,660
14,786	633	955	604	1,487	3,318	3,873	13,569	7,393
138,268	5,918	8,934	5,649	13,903	31,024	36,214	126,883	70,870

More Information

- www.FloridaDisaster.org/gis
- www.gridresponder.com
- www.fgdc.gov/usng
- http://data.geocomm.com/
- http://mississippi.deltastate.edu/
- www.fidnet.com/~jlmoore/usng/
- Rand.Napoli@iem.com
- Carla.Boyce@iem.com

Questions?